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THE CRIME AT SIANFU
CHANGING CHINA FROM WITHIN
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The Crime at Sianfu

By C. J. LAVAL

To those who have scoffed at the existence of a "communist menace" in China, and for those who have insisted that Japanese fears of Russian encroachment are without basis, the answer was given in December, in Shensi, in Kansu and along the western borders of the country where Chinese Red armies are concentrated, subservient to orders that come from Moscow.

The seizure at Sianfu, on December 12, of the person of Generalissimo Chiang Kai-shek by the man he befriended and protected just a few short years ago, in all likelihood will be found to be a simple act of banditry, carried out in accordance with all the familiar precedents of outlawry in Manchuria where Chang Hsueh-liang had his schooling at the hands of past masters in the arts of criminality. The minds directing the march of communism in Asia, probably regard this incident with a measure of complacency, and friendly counsel for the kidnappers from leaders of Chinese Red forces in the west assuredly was not lacking, for since 1927, these Red leaders have had no love for Chiang Kai-shek, but no Chinese is so mistaken as to believe that Chang Hsueh-liang in what he has done is in close alliance with, or has been admitted to, the inner circles of communist direction in China. The Red leaders in China would never lean on so weak a reed as Chang Hsueh-liang, who, five years ago, was dancing through a drug-bemused existence in Peking when his patrimony in the North was rudely snatched out of his weak grasp.

That was an unhappy time for the "Young Marshal," the son of Chang Tso-lin, who was once the great overlord of all Manchuria. The nation blamed Chang Hsueh-liang primarily, and perhaps unjustly, for he was but the product of a regime of corruption, for the loss of the three northern provinces. In this tragic period of his career, he had the sympathy and direct help of Chiang Kai-shek and other Nanking leaders, and when he returned to China from a tour of Europe that he saw fit to take at that time, his faults were glossed over by his Nanking sympathizers, and he was appointed to an important post in the Nanking Government's military service. He had valuable help also at that time from Nanking friends, it is said, in retaining possession of a great portion of the vast wealth he had inherited.

A Time of Crisis in China

This, then, is the young man who, as these lines are written is holding his former benefactor, Generalissimo Chiang Kai-shek, prisoner, along with a number of other Nanking Government

dignitaries at Sianfu, Capital of Shensi. Chang Hsueh-liang had been stationed in Shensi by the Government at the head of a formidable military force to check the advance of communist armed forces into the country. This was the job assigned to him and, characteristically, he fell down on the job. Reports have been filtering into Nanking, through recent months, that Chang Hsueh-liang and the officers under him, instead of opposing the menacing Red troops, have been fraternizing with them. Through these recent months the Nanking Government has been passing through one of the gravest crises in the history of the nation. As head of the Government, Generalissimo Chiang Kai-shek has been called upon in this period, within the country and outside of it, to face a series of problems sufficient to tax the genius of any statesman and in this great task the world at large concedes that he has acquitted himself creditably. It has been the considered decision of the Nanking Government, since it was organized in 1927, to oppose the encroachment of Russian Communism into China and to this extent at least, the Nanking Government shares the Japanese viewpoint regarding this menace to peace and order in the Far East. The Tokyo Government has made it plain that in defence of ordered Japanese institutions, it will not tolerate the near approach to Japanese shores of this vast menace and as answer to criticisms of moves Japan has been making in recent years in Asia, Japanese statesmen point to the northern frontiers of Manchuria along which, in steel and concrete defences lies one of the greatest armed forces in the world, the Far Eastern Army of the Soviet, said to number 300,000 effectives, self-sufficient, mechanized and equipped with every device of modern warfare. The Japanese dread of this menace is emphasized, when it is realized that the great Japanese centers of population and industry lie but 700 miles distant from starting grounds in Vladivostok of great forces of Russian bombing

airplanes supported in the sea by an unknown number of modern submarines equipped and ready in the same northern port.

The kidnapping crime of Chang Hsueh-liang at Sian with the defection of his forces, followed by the defection of Yu Hsueh-chung, Chairman of Kansu and the army he commands, at once cripples the strength of the Nationalist forces of China at a strategic point and aligns all these former Government forces with their equipment with the enemies of the Nanking Government, the leaders of the Red armies that were driven out of south central China by Chiang Kai-shek in 1934. With the Red



Behind this portal, entrance to the Governor's Yamen at Sianfu, the fate of Generalissimo Chiang Kai-shek and the other captives held by Chang Hsueh-liang was being decided late in December

forces of Outer Mongolia under Russian officers as a link, a contact is thus established between the Red forces in western China and the Far Eastern Soviet army north of Manchoukuo. If an advance of Red forces can be achieved south of the Great Wall into central China, the Empire of Manchoukuo, Japan's ally, will be brought between the jaws of a nutcracker of hostile forces, north, south and to the west. It is understandable, therefore, that Japanese apprehensions have been galvanized by the incidents that have unfolded in Shensi and Kansu.

Another War in China

The fate of Chiang Kai-shek in the closing days of the year hung in the balance. The lustre of his record of service for his country will always remain to inspire those who follow in his footsteps. As it appears that his kidnapping by Chang Hsueh-liang essentially was but an act of banditry, it seems probable at this time, in the closing fortnight of the year, that terms that customarily are made with outlaws in China may be arranged, and with the payment of some tens of millions Chiang Kai-shek will win release and be enabled to return to Nanking to take up again the heavy burden of Government affairs. It is inevitable that another era of internal warfare in China is opening, bringing again death and destruction for long suffering people.

Destiny assuredly is dealing with Chang Hsueh-liang as a child of misfortune. His own fate hangs in the balance at this time more ominously than does that of the man he has made captive at Sianfu. In all of China's long history it would perhaps be impossible to find another individual who, twice within the space of a single decade, has won to the unworthy eminence of being the best hated man in the nation. And ten years ago in the view of not a few Chinese leaders, the possibility was foreseen that Chang Hsueh-liang would mount the Dragon Throne at Peking as Emperor and founder of a new dynasty. That was the dream of the old bandit overlord, his father, Chang Tso-lin, who fought his way to supreme control of the three provinces of Manchuria, and ruled there contemptuous of any external interference with more power than any monarch of his time. Chang Tso-lin dreamed of making his eldest boy, Chang Hsueh-liang, the Emperor of China, and the opening scenes that were to foreshadow this event even were enacted in Peking when Chang Tso-lin, exacting all the honors that formerly had been paid only to Imperial rulers in China, marched into the old Capital over a roadway covered with golden sands, in keeping with ancient imperial traditions. At that time, the deposed Boy Emperor who, as the Emperor of Manchoukuo to-day, rules all Manchuria, was a fugitive in hiding, dependent for his safety on the good offices of friends in foreign Legations.

As his mentor and companion when the tide of his father's power in China was at highest flood, and the might of the Fengtien forces had been extended as far south as Shanghai, Chang Hsueh-liang had the late Chang Tsung-chang to guide and teach him. It was that one-time Chinese stevedore on the docks of Vladivostok and former ruler of the Province of Shantung, who used to travel in state about China in a special train, one or two coaches of which were devoted to the uses of his harem of twenty-odd young women of assorted nationalities whose charms, it is said, Chang Tsung-chang was commonly willing to share with favored guests. Chang Tsung-chang was shot and killed at the railway station at Tsinan by an assassin, who suffered only a light punishment for the crime at the hands of a Chinese court. The assassin pleaded that the former Shantung war-lord had murdered his father.

Chang Takes Center of Stage

The events at Sianfu appear to indicate that Chang Hsueh-liang again has become the victim of evil counsellors. It is said that in recent months his authority has been undermined by younger officers in his command, who have made common cause with the Communist leaders, and it is known that no clashes between the Communist forces and the troops under Chang Hsueh-liang have taken place within the past nine months. It was this situation that led Chiang Kai-shek to visit Sian, and it was no secret that he intended to replace Chang Hsueh-liang, as the appointment of General Chiang Ting-wen, Pacification Commissioner for Fukien to command the North-west Bandit Suppression Forces had been announced. It may be that in the seizure of Chiang Kai-shek, Chang Hsueh-liang was carried along by forces beyond his control;

but after the crime was committed it is apparent that speedily he fell into line with the designs of the conspirators and even took the center of the stage.

Thus he was heard in a series of telegrams addressed to officials in various parts of the country, and in radio broadcasts attempting to justify by fantastic arguments the crime that he then sponsored. In these outbursts of spurious patriotism he denounced what he called the "continuous maladministration" of the Nanking Government under Chiang Kai-shek and announced his determination to fight China's enemies and rebuild the nation. It is said that Chang Hsueh-liang succeeded in throwing off his addiction to morphine and other drugs when he was away in Europe, but in view of his recent utterances, the efficacy of any cure he may have achieved may fairly be doubted, for he is heard asserting that he intends to take the lead in "reorganizing the Chinese nation," expelling its foreign enemies, recovering lost territories, including the provinces in the north that his own family formerly governed and,—what rings oddly in northern ears who saw this young man remain unmoved when the peasantry of Manchuria, his own people, reduced to slavery,—in promoting the happiness and welfare of the people.

As time passed the armies of the Nanking Government were encircling Sianfu, and fleets of Government bombing airplanes gathered in striking distance of the Shensi capital. Through the latter portion of December, definite military action against the rebellious forces necessarily was curbed, for such action would endanger the personal safety of Chiang Kai-shek and the other captives being held with him.

Up to the present no harm has come to foreigners residing in Sianfu, and messages that were received in Shanghai from various mission stations located there conveyed the word that "all was well" with missionary residents of these stations.

Included among the Nanking officials who were seized and held captives in the Sian outbreak are:

Gen. Chu Shao-liang, Pacification Commissioner for Kansu.
Gen. Chen Cheng, Administrative Vice-Minister of War.
Gen. Chiang Ting-wen, Pacification Commissioner for Fukien.
Gen. Wei Li-huang, Field Commander of the Anti-Red Forces of the North-west.
Gen. Chen Tiao-yuan, President of the Military Advisory Council.
Gen. Chiang Tso-pin, Minister of Interior.
Shao Yuan-chung, former Chairman of Central Publicity Council.
Gen. Chen Chi-cheng, former Garrison Commander at Hankow.
Gen. Chiang Po-li.
Lieut.-Gen. Mao Pang-chu, former Dean of the Central Aviation Academy at Hangchow.

Chinese Tungsten Ore

Tungsten is principally produced in Kiangsi, but also in Kuantung and Hunan. The output of ore in China represents over 60 per cent of the total world production, and almost the whole output is produced for export. China began to market tungsten ore on a large scale in 1918, in which year 10,000 tons were mined and 9,400 tons were exported. Between 1923 and 1928 exports as well as output decreased, though over 7,000 tons were exported in 1926 and 1928: 1929 saw a revival with an export of nearly 9,000, followed by another period of depression which reached its lowest ebb in 1932, when exports amounted only to 2,044 tons. Conditions improved again in 1933 when 5,252 tons were exported, and in 1934 the figure reached 4,432 tons, and prices were the highest recorded in recent years. Since the revision in September, 1922, of the import tariff in the United States, to which almost the whole output in China had up till then been exported, Chinese tungsten ore has gone also to the United Kingdom, Germany, and France.

A scheme by which tungsten ore from southern Kiangsi, the principal producing area, should be exclusively exported through a foreign agent at prices fixed by the Ministry of Industry, and by which the National Government would obtain a monopoly control of production and sales, was agreed upon in 1933, but eventually abandoned. In December, however, the Department of Reconstruction at Canton, through which the ore is normally exported, set up a Kwangtung Wolfram Monopoly, from which permission to purchase and to export the ore has since to be obtained.

Changing China from Within

By Dr. R. T. SHIELDS, former Dean of Department of Medicine, University of Nanking, Nanking, China; Associate Dean, Cheeloo University School of Medicine; Shantung Christian University

(The following paper was given at the Round Table Session of the Institute of Public Affairs, University of Virginia, in July, 1936)

THIS paper is concerned with the changes which have taken place within China during the Nineteenth and Twentieth centuries. The contacts which China had had with Europe and America previous to 1805 had produced practically no effect on the lives and customs of the people, but in that year, Dr. Pearson of the East India Company introduced the newly discovered method of vaccination against smallpox into Canton. And in 1807 Robert Morrison, the first Protestant missionary to China, arrived in Canton. Besides his preaching work, he studied the written language, produced the first Chinese-English Dictionary and translated parts of the Bible into Chinese. Upon so proud and self-satisfied a people, suspicious and ignorant of the customs of the West, very little impression was made for several decades. The first medical missionary arrived in Canton in 1834, and during the Nineteenth century thousands of Protestant missionaries, most of them sent out by British and American Societies, came to China and started churches, schools and hospitals. Most of the Roman Catholic missionaries were from France or Germany. In the '80s the first group of Chinese students were sent to America to study. The seeds sown were bearing fruit, new ideas were permeating a small fraction of the vast population. But the high-handed methods pursued by certain Governments had produced a feeling of fear and hate toward the foreigners, especially among the officials of the Manchu dynasty which had ruled China since the middle of the Seventeenth century. This feeling culminated in the abortive attempt of the fanatical "Boxers," backed by many of the officials, to drive out the foreigners in 1899-1900.

It was after this event, that extensive and rapid changes began to take place. In 1906 the Dowager Empress did away by imperial edict with the old system of classical education and examinations, by which all officials were appointed to office, and instituted a new system of modern education. She died in 1908 and in 1911 the Revolution led by Dr. Sun Yat-sen broke out and in a few months forced the abdication of the Manchus, and changed the oldest and largest Empire in the world into, nominally at least, a Republic.

It is not my object to dwell on the numerous political and military changes that have taken place in the last twenty-five years. New alignments and resulting civil wars have occurred so often as to confuse not only observers abroad, but even those who have lived in the midst of these intrigues and wars. In a country the size of China, with so immense a population, it was almost inevitable that a period of chaos and disorder would prevail after the revolution. And the attitude and actions of certain foreign powers have certainly served to accentuate and prolong this phase of domestic discord.

One should always bear in mind that the unit of Chinese society throughout the past centuries has been the family. There was intense personal loyalty to the family, then to the village, and to a certain extent to the province. But a feeling of national patriotism was almost non-existent under the old regime. The Chinese never venerated a deified Emperor as the Japanese do. The remarkable fact is that in spite of intrigues and revolutions there has been a very real and efficient progress along many lines of modern civilization.

Engineering

The National Economic Council and the Ministry of Communications have initiated and financed, in co-operation with the various provincial and municipal administrations, important schemes for waterways conservation, irrigation, railway and highway construction, and the establishment of airways. The Hankow-Canton Railroad is completed, and opened to traffic. In constructing the

last link of the road through the mountains between Kiangsi and Kwangtung provinces, numerous tunnels and bridges had to be made. By means of this road it is possible to travel by rail from Canton to Peiping and on to Berlin, the trains being carried by ferry across the Yangtze river. The railroad from Shanghai to Hangchow is being extended to meet this line at Changsha in Hunan. The Peiping-Nanking-Shanghai line has been in operation for twenty-five years. The road from Haichow on the coast now runs to Sian in Shensi, and it is planned to extend it to Lanchow in Kansu province. A number of other roads are projected as part of the Governmental system.

More than 40,000 miles of highways have already been constructed, many of the roads being well surfaced. The plan, when completed, calls for over 200,000 miles within the next few years. The first motor roads in Shansi and Shantung were built fourteen years ago with American Red Cross money, as part of the Famine Relief project. In Shantung province alone in recent years over 10,000 miles of earth roads have been made and at present two hundred Ford twenty-passenger buses are running throughout the province. There are only about 50,000 motor vehicles in China and a large number of these are buses operating on the Government owned roads.

In air transportation there are three companies operating regular passenger and mail services three times weekly between Peiping and Shanghai, and Shanghai and Canton, and from Shanghai to Nanking, Hankow, Chengtu and Lanchow, besides other connecting routes. In China modern highways and airways have followed so soon on the railway age, that the Government should be able to co-ordinate the three systems in a very efficient manner. The results brought about by the intercommunication of the people of different sections is bound to have a great and increasing influence in breaking down the age long provincialism of the people, and in bringing about a greater unification of the nation.

All of the larger, and many of the smaller cities have established electrical power plants, and some cities already have adequate waterworks. In Nanking, for example, the water is pumped from the Yangtze River about five miles to a modern filtration plant and reservoir to supply pure water to that large city. In the larger cities there are increasing numbers of steel-concrete buildings, notably the new Government buildings in Nanking, and business buildings in Shanghai. This year there was opened in the latter place a department store of thirteen stories, air-conditioned, and operating the first escalator to be installed in China.

Irrigation projects are already under way in the West, which are expected to add hundreds of thousands of acres of arable farm land, and enable those arid sections to be capable of supporting many times the present sparse population.

The Government owned telegraph system has been operating for years, local telephones are common, and now long distance telephones and radio stations are being established. The postal system is most efficient and has been carried on in all parts of the country almost without interruption, even during the disturbed conditions occurring in many sections during the last twenty-five years. It has steadily increased in efficiency and in the amount of mail matter carried, due to the increasing facilities of communication. Recently a division for postal savings, and one for life insurance has been added to the Postal department.

In scientific Agriculture and Animal Husbandry a good beginning has been made. In inaugurating these departments the Government has been greatly assisted by the pioneer work done by such institutions as the Agricultural Departments of the Mission Universities of Nanking and Lingnan. The National Economic

Council has set up several experimental stations to investigate such problems as seed selection, plant diseases, animal breeding, and veterinary medicine, and the results achieved by such studies have been very conspicuous in certain sections of the country.

In line with what is now being done in several localities in England and the United States, certain cities as Tsingtao, Shanghai, Nanking, and Canton have already taken steps to do away with their slum areas, by building blocks of small, low-rental houses or dormitories for the use of poor families, or single men, who have been living in dirty, unsanitary mud huts.

Education

To attempt to develop a modern system of education in a population of four hundred million, with illiteracy estimated at eighty per cent or more, and with the majority of the people scarcely able to obtain the bare necessities of life, was a tremendous undertaking. When the Government undertook this task there were a few men who had been educated in Europe or America, and there were hundreds of more or less well educated men and women who had been graduated from the Mission Schools and Colleges, which had started from scratch about one hundred years before. But the number of qualified teachers was wholly inadequate when compared with the vastness of the undertaking. More students were sent abroad, the American Boxer Indemnity Fund greatly assisting in this. With these returned students, and those qualified locally, the Government began to establish and equip schools of different grades. The children of school age are estimated at forty million, and yet the Ministry of Education is planning by 1939 to have all children attend at least one year of compulsory education in a school! In 1935 there were 259,000 primary schools with 11,700,000 pupils; 3,000 secondary schools with 536,000 pupils; and 109 colleges and universities with 46,758 students. Vocational and technical education is being more and more emphasized.

But this educational system, vast as it is, does not touch the large majority of the illiterates of the nation—the adults, and the educational leaders were not content to educate only the children who would constitute the next generation. Therefore definite efforts are being made to reach this class of illiterate adults by means of adult schools, and the printed page. The time and mental effort needed to master the classical written language made it impracticable to require a knowledge of this classical style for the average school pupil, much less for the farmers and working men and women. The well-known scholar and philosopher, Dr. Hu Shih, has been the leader in advocating a practical simplification of the style of writing and printing, by making the construction of the written language the same as that of the National language, as spoken by the large majority of the people. This naturally raised protests from the old orthodox conservatives, but public approval seems to be behind the liberal movement. This simplification movement has been carried still further by the "Mass Education Movement" which uses in its publications only 1,000 ideographs. Another experiment which is considered very practical by most of those who have used it, is the adoption of a limited number of phonetic symbols by which the sounds of spoken words can be spelled. This is practically imitating the methods adopted by the Koreans, and the Japanese in their efforts to express their written language in a more simple manner than that of the Chinese characters.

The net result of all this effort directed towards education has been tremendous. The National language (called "Mandarin" by foreigners) is taught in the schools of all provinces and this naturally tends to break down isolation due to local dialects, and also allows the easy migration of college students from south to north, and from west to east. All such movements help towards nationalization. English is taught as a language in most of the higher grade schools, while German, French and Japanese is taught in some.

The development of athletics, largely due to English and American influence is an important corollary to the educational program as by this means not only is the physical condition of the boys and girls improved but team-work, the control of temper, and the difference between "saving face" and "sporting spirit" is inculcated. The growth of interest in athletics has been remarkable, not only among the students, but also among the people in general. Many large modern stadia have been recently erected, notably the one in Nanking, and the new million dollar one in Shanghai.

We are thus seeing develop thousands of modernly educated young men and women, ready to take their places in the new China, and to hold their own with the educated classes of any other nation. What the effect of this will be on China and on the World we can only conjecture. But we can be sure that China has entered on a new era and we can hope that she will add what is best of modern education and science, while she retains what is best of her own age long civilization and culture.

Medicine

As we have noted before, vaccination against smallpox was introduced in Canton in 1805. But it can be said that the introduction of modern scientific medicine into China was made by Dr. Peter Parker, a medical missionary and a graduate of Yale, in 1834. The celebration of the centennial of this event and of the founding of the first hospital in China was held by the Chinese Medical Association at its meeting in Canton in 1935. It is interesting to remember that Lister and Pasteur were small boys when Parker went to China, and that ether and chloroform were not used as anesthetics until the next decade. For at least seventy years the practice of modern medicine was in the hands of the medical missionaries. By 1899, one hundred and ninety-six of these men and women had gone to China, nearly all of them being sent by British and American missionary societies. In 1886 the Chinese Medical Missionary Association was formed, and a Journal was begun which has continued to the present. In the early years most of the hospitals trained their own assistants, and some of the larger and better equipped ones had very efficient training schools. Many of the graduates of these hospitals became very capable physicians and surgeons. But the first effort to establish a more up-to-date school, by the united forces of several missionary societies, was made in Peking in 1906. It is interesting to note that just at this time the revolution in medical education began in America, which has resulted in reducing the schools to half of the former number, and raising tremendously the standards of education in this country.

The progress made in China in medicine and medical education in recent years has been remarkable. Thirty years ago there were in China very few properly qualified doctors and probably no Chinese trained nurses. No more marked change has taken place in China than that shown by the attitude of women towards Society, and Society's attitude towards women, and nowhere is this changed attitude expressed more conspicuously than in the medical and nursing professions. Of thirty medical schools officially listed, only two are for women exclusively, and the others are, so far as I know with few exceptions, co-educational. In many of the schools women constitute about twenty per cent of the student body. At first owing to social traditions, approximately equal numbers of men and women were trained as nurses, but gradually, as has happened in all other countries, the women are almost entirely occupying this field.

It was not until 1915 that there was a sufficient number of young doctors to form the National Medical Association which co-operated closely with the older China Medical Association founded in 1886. In 1932 by unanimous agreement, these two Associations united to form the Chinese Medical Association, membership in which is open to properly qualified doctors of any nationality. In 1935 the membership of the Chinese Medical Association was 2,400, not more than 300 of these being foreigners. It is probably safe to state that there are 5,000, more or less, well educated practitioners of modern medicine in China to-day. There are probably 400 hospitals (260 being mission hospitals) and 30 medical schools (six being mission schools). The Nurses' Association reported 2,456 members in 1935, and 162 nurses' training schools. Statistics for the 260 Mission Hospitals in 1925, give 325 foreign doctors, 530 Chinese doctors, 271 foreign nurses, and nearly 1,000 Chinese graduate nurses with almost 4,000 pupil nurses in training.

The pioneer apprentice-training Mission Medical Schools, by co-operation and elimination, have been reduced to six union schools. The former Peking Union Medical College was taken over and reorganized by the Rockefeller Foundation in 1916. This school compares favorably with any medical school in the world. There is also the Hongkong (British) University School of Medicine and the Japanese Medical College at Mukden. Besides these partly or wholly foreign controlled institutions, there are 18 schools maintained by the Central or Provincial governments or by private funds.

Most of these schools, owing to the lack of qualified and experienced teachers, have not yet been able to come up to the standard of the older schools, but the National Medical College in Shanghai ranks with the best in the country, and several others have shown great improvement.

I shall take the school with which I am connected as a good example of the mission medical schools. Cheeloo University consists of the School of Arts and of Science, and the School of Medicine. This medical school was reorganized by the co-operation of nine missionary societies of the British Isles, Canada and the United States. These societies now support twenty-two doctors and nurses in the school and its affiliated hospital, and make financial grants also. Grants have also been received from the Rockefeller Foundation for twenty years, and recently from the China Foundation (American Boxer Indemnity Committee) and from the National Ministry of Education. There are thirty-four full time members of the teaching staff, eighteen of whom are Chinese, and there is a student body of approximately one hundred each year, divided into five classes, the last year being a required internship. The entrance requirements and the curriculum are based on the minimum requirements of American Medical Schools, and this fact holds true for all of the better medical schools of the country. The language of instruction in medical schools is Chinese or English, or a combination of the two, although in some institutions German is used instead of English.

The National Public Health Administration was organized several years ago and is housed in a large modern building in Nanking, where the central offices for the various health investigations and activities for the whole country are located. From this center an increasing number of urban, rural, and school public health activities are being set up, in co-operation with the provincial and municipal administrations concerned. Field research work has been started emphasizing the study of medical conditions especially important, or peculiar to Asia, such as tuberculosis, malaria, hookworm, leprosy, cholera, kala-azar, schistosomiasis, etc.

Another most important project is the establishment of Training Schools for mid-wives. The first was started in Peiping several years ago by Dr. Marian Yang and has already proved its great value; others have been established in Nanking and other places. Only those who know of the lack of medical care for the vast numbers of mothers in China, can appreciate the amount of good that will be accomplished by these trained mid-wives.

Two significant movements started by General Chiang Kai-shek and his Wellesley educated wife should be noted. After the devastation of Kiangsi province by the Communists and the occupation of the province by the armies of the Central Government, steps were taken to rehabilitate this large area by helping the poverty stricken and desperate people to make a living again. The scheme was financed by the National Economic Council; and the Army, the Chinese Christian Church and local missionaries are assisting in the work. Financial aid is given by loans through co-operative societies, and agricultural, educational and medical aid is also given. The results have proved so gratifying that the National Economic Council has now set up a similar plan for the rehabilitation of the northwestern provinces, road building and irrigation being part of the general plan.

The "New Life Movement" started in Nanchang the capital of Kiangsi, and has now become nationwide. Four Chinese characters which can be translated Courtesy (of the heart), Duty (to one's self and others), Rights (of self and of others), Honor (integrity) were adopted as the watchwords of the movement. The general idea is to inculcate the principles of morality, honesty, personal and civic hygiene and sanitation among the people. Many thousands have already joined this movement and the results in many localities have been conspicuous. There is an intangible change that is being manifested in recent years in Chinese society. The Christian spirit of service for others is producing an influence which is gradually replacing, or revivifying, the old Buddhist idea of laying up "merit" for self. Proof of this statement is shown by the existence of the two "movements" noted above, by the predominant part taken recently by the Chinese in famine relief work, by the activities of the Chinese Red Cross Society, by the formation of the "Dao Yuan" sect, a kind of attempt to combine the ancient Taoism with Buddhism, Mohammedism and Christianity, by the formation of the Swastika Society, similar to the Red Cross, by the formation

of the Chinese Leper Society, and by other philanthropic institutions and organizations.

I have tried to give a brief account of the important changes that have taken place within the last hundred years in China. This account would not fairly represent the situation if I did not mention some of the incomplete efforts, some of the failures, and some of the difficulties and dangers which must be faced. Many of the changes are far from complete, and not all of the changes are for good. There has been a tendency in some instances to give up some of the old manners and customs which would better have been retained, and accept some of the least desirable, if not actually harmful features of western civilization. Occasionally old idols have been smashed, but atheism substituted for them; sometimes liberty has been interpreted as license.

In government it has been impossible so far to set up a truly democratic system based on the will of the people as expressed by their votes. The Republic is governed by a bureaucratic form of one-party government, which some observers think is following the apparent tendency of modern governments towards a Dictatorship.

In politics the traditional idea of loyalty to the family naturally makes for nepotism and the spoils system; but an American who is only slightly familiar with the acts of a certain class of politicians in this country, can ill afford to throw stones.

One of the vices which has cursed the country during the past hundred years is that of Opium, the common use of which was forced upon the Chinese by a foreign power for commercial gain. By agreement between the British Government and the then reigning Manchu dynasty in 1906, the importation and cultivation of opium was practically stopped within ten years. But some smuggling by subjects of foreign powers, and unscrupulous Chinese still continued, and the cultivation of poppy was later reintroduced in many sections by certain selfish avaricious War-lords. The drug traffic has recently been again greatly reduced, as drastic laws against it are now being enforced in most of the country, special hospitals for addicts have been established, and "repeaters" are fined, or jailed, or shot. But in certain sections of the country where the authority of the Chinese Government has been actually, if not legally suspended, it has been impossible to enforce the laws, and opium, morphine, and heroin are clandestinely or openly sold, under the protection of extra-territoriality and the mailed fist.

In the realm of mechanical engineering, the Chinese, though they have made great progress, have yet much to learn. Locomotives, motor-cars, airplanes, and the finest technical instruments still have to be imported from abroad. The old idea of "difference not much" (tsa pu to) may be largely responsible for the lack of technical accuracy necessary in designing and constructing the highest types of machines. This fact is rather surprising, when one remembers that the Chinese are masters in such arts as painting, carving, the manufacture of porcelains, the making of tapestries, embroideries, etc., all of which require great manual dexterity.

In the introduction of modern education, as noted before, the lack of equipment and adequate personnel and the size of the undertaking have naturally prevented, in a short a time, many of the schemes proposed from succeeding as the promoters had hoped. A great deal remains to be accomplished but when one considers the vastness of the problem in respect to area, population, poverty, illiteracy, and the present political and military situation both internal and external, and remembers what has been accomplished within the last twenty-five years, one can confidently expect that the Chinese will weather the present storm and ultimately attain to their rightful position among the nations of the world. The race has the characteristics of industry, patience, courage, frugality, common-sense and mental ability to justify such an expectation.

Gradually clanism and provincialism are giving way to a spirit of nationalism. Let us hope that China as well as the rest of the Nations will not stop at nationalism, but will go forward and realize a broader spirit of internationalism, and thus make possible a new era of goodwill on earth among the nations, a real brotherhood of Nations, mutually interdependent and mutually helpful.

The old Chinese proverb "Within the four seas, all are brethren," originally applying to that nation alone, should be so interpreted as to embrace all nations. The negative aspect of the Golden Rule as taught by Confucius is not enough for China, or for any other nation. Only the positive command "Whatsoever ye would that men should do to you, do ye even so to them" is adequate for nations as well as individuals if a new day of human relationship is to be attained.

Trade Relations with Japan

By R. A. MAY, Vice-President, General Motors Export Company

(The following is the text of an address delivered at the American-Japanese Trade Council Session of the Twenty-third National Foreign Trade Convention, held in Chicago in November).

THIRTY years ago, Japan was—probably to most of us—merely a country located at the East Coast of Asia, populated by too many people, growing cherry trees and silks, and sending into western countries expensive silks, kimonos and tea sets. Occasionally we encountered in the class room a quiet little Japanese trying with admirable patience to overcome difficulties of language and various subjects at the same time. Aside from this, we probably knew that Japan had just won the Russo-Japanese War. However, that did not seem either very interesting or significant.

Ten years ago, in 1926, when I first landed in Japan, I found a country very much different from what I generally had thought it to be. Western civilization and methods had already taken firm root in the economic activities of the people. Modern buildings, big banks, up-to-date newspapers, hydro-electric power and light everywhere, electric street cars, a very efficient steam railroad system, new factories, and modern department stores could be seen, to all intents and purposes, if not actually, right alongside of century-old farmhouses or ancient shops still displaying classical paper signs and lanterns. What struck me most at first was the industry of the people, their obvious desire to do diligently what they intended to do. The man who did a job did it seriously—inexpertly sometimes—but nevertheless intensively and all-absorbingly.

After 1926, the technical and economic changes taking place in Japan were driven home to me still more forcibly every third year or so when I returned to Japan from my regular trips to the United States and to Europe. In 1932, for instance, when I visited America, I found factories closed, millions of people out of work, business almost paralyzed, and grave concern everywhere as to the future. When I came to England, I saw similar conditions. In Europe and in the United States, famous transcontinental trains were less in number, and those in operation were only two-coach trains with most of the passenger space unoccupied. Whenever I returned to Japan, the country seemed a beehive of activity by contrast: the chimneys sending forth clouds of smoke; everybody with a job to do and doing it; skilled labor always scarce. Actually, Japan was more prosperous than ever at the very time when the Western countries were down with the most serious depression in their history.

Over the years, as I stayed on in the country, I came to witness what was actually, and is to-day, one of the most remarkable economic transformations of all times. I can really say, from closest observation, that Japan is a modern, highly industrialized nation with all modern industrial facilities, methods, and technique available at hand or at close command. Japanese industries not only have been developed on a wide and highly diversified technical basis; they also have been organized according to most up-to-date business principles. Banking and trade have been equally well developed and, as most of us well know, Japanese trade has expanded worldwide with prodigious and successful activity.

As we are interested primarily in this trade, a brief review of the historical record and of the outstanding features, of present day Japanese trade might be appropriate and useful by way of background.

Japan's Foreign Trade Record

The Earliest Beginnings.—European countries and international traders learned of the Japanese early in the Middle Ages. According to all legend—passed from mouth to mouth—there was a powerful emperor somewhere on rich and beautiful islands in the East.

But that was all they knew. Therefore, it is not surprising that Columbus, when he tried to find the West course to the East, and landed in Cuba in 1492, sent messengers into the interior to carry letters to the Sovereign of Japan, inviting him to start trade and cultural relations with Spain. He thought he had sailed around the globe and found those legendary islands.

First recorded European contact with Japan was made, however, by Vasco de Gama in 1520. Soon afterwards, Japanese goods

appeared in Europe—pearls, silk, spices, and queer shaped weapons. The usual trade route was the "Mongol Route" via Central Asia.

In 1573, Oda Nobunago, the dictator, welcomed the first missionary, the Jesuit Xavier, to Japan, but in 1593, Hideyoshi, the dictator succeeding, had nine missionaries burned alive, and further Christian proselyting was forbidden by law.

Dutch and English traders began to visit Japan soon after 1600; but in 1637, Tokunaga Iyemitsu, the Shogun, restricted trading rights to Dutch and Chinese who had to meet the Japanese traders at Nagasaki. No foreigner was permitted to visit other towns until 1870, when the country was opened freely to foreigners. Present day restrictions on foreigners desiring residence in Japan may remind us sometimes of those old days—three hundred years ago.

The first railroad was built in 1872, the first year of the Meiji Era or the great Restoration from Yokohama to Shinagawa (Tokyo), and modern banking and commerce were introduced between 1880 and 1900. Paper, and cotton-spinning and weaving mills were the first modern factories in Japan.

Out of these small and actually quite recent beginnings grows Japan's industrial plant which to-day is perhaps broadly the most modern mass production industrial system yet developed.

Japanese foreign trade grows in proportion. For many years, Japan's main Imports were cotton and wool textiles, iron and steel products, machinery, and foodstuffs; her main Exports consisted of silk, silk textiles, cotton textiles, and numerous specialties. A great variety of small industrial products was made in Japan: but only small quantities were exported mainly to Korea, China, and other neighboring countries.

The Political Foundation of Japanese Foreign Trade.—Japan's foreign, and particularly, Far Eastern trade, has increased not only in line with industrial development but also in line with expanding political power and influence. This has been of greatest significance. The Korean trade was obtained first by retrenchment of Russian influence in 1898, and finally, that of all the other Western powers in 1905. Trade influence in China began rapid expansion after Japan joined the international relief expedition to Peking during the Boxer Uprising in 1900. Trade with Manchuria took root after the defeat of Russia in 1905. Substantial financial and industrial penetration in China was made possible by Japan's political successes in the World War. More recently, the establishment of Manchoukuo has helped further to increase Japan's foreign trade and industrial activity. In 1934, Eiji Amau, a Tokyo Foreign Office spokesman, pronounced what is the equivalent of a Monroe Doctrine for the entire Far East or, I should say, East Asia, and thereby, obviously political basis was created for the most recent expansion in Japan's foreign trade in North China. This Japanese Monroe Doctrine probably also explains, at least in part, the determination and success with which Japan proceeds in putting her Trade Empire on a permanent basis.

The Progress of Modern Japanese Foreign Trade.—To demonstrate the phenomenal growth of Japanese trade, I should like to mention a few figures:

In	Japan Exported Merchandise Worth	and Imported Goods Worth
1900	Y 204,430,000	Y 287,262,000
1935	2,499,073,000	2,472,236,000

Thus, Japan's total foreign trade grew from 492 million (Gold) Yen in 1900 to 4,971 million (Paper) Yen in 1935; a growth of 910 per cent in 35 years!

Our own total foreign trade (U.S.A.) grew from 2.2 billion (Gold) Dollars in 1900 to 4.320 billion (Paper) Dollars in 1935; an increase of only 96.4 per cent in 35 years.

Great Britain's foreign trade was at 877,449,000 Sterling in 1900, and was at approximately 1,247,023,000 Sterling in 1935; an increase of only 42.1 per cent in 35 years.

I know that fluctuating and depreciated currency values cannot be compared outright with gold values, but even if all the

figures would be expressed in gold and put through all kinds of other adjustments, Japan would still be far ahead of all other trading nations in terms of trade expansion and particularly of foreign trade increase. The showing would be still more impressive if foreign trade could be measured in weight or by physical volume.

There is, however, one feature of this record which is worth noting.

Only seven times in these 36 years has Japan had an excess of merchandise exports over imports. Accordingly, for the most part, the trade balances have been unfavorable, and clearly reflect dependence on foreign sources of raw material supply. If one considers this, he also comes to understand Japan's national desire to back up foreign trade by political measures. This seems the more logical as the raw materials which Japan must import are the much coveted raw materials of international trade diplomacy, such as cotton, wool, timber, coal, iron ore and petroleum.

A relative shortage of petroleum is still the most serious national problem. It will be very interesting to see in what new ways Japan will try to overcome this deficiency in the future. So far, eager competition of British, Dutch, American, and Soviet companies meets present needs at reasonably low prices and obligatory storage is intended to provide at least six months emergency protection. Hydrogenation will probably be resorted to as soon as costs of such production will have been reduced.

Cotton has been for a long time the most important raw material imported for Japan's textile industries. The demand is still met mainly from the United States, and Japan is, by far, our largest customer; but when prices went too high here the last few years, and cotton-growing was taken up by other countries more seriously, Japan began to buy in India and Brazil, and seek other sources elsewhere. To-day, Japan not only buys the bulk of India's cotton; but many of the plantations there are owned by Japanese. Brazil's exports of cotton to Japan in the first six months of 1936, were eleven times those of the same period of 1935. This benefits Brazil as well as the Japanese cotton planters established there by Japanese Government-supported colonization. Cotton culture in Manchoukuo and China is similarly being fostered. In all their efforts to establish new sources for cheaper cotton, the Japanese thus appear more successful than the British who have been continuously trying to do the same thing over the last seventy years, or since our Civil War, through their several Empire cotton-growing schemes.

Japanese cotton piece-goods have conquered the international markets so rapidly and so disturbingly to long-established custom over the last few years that 43 countries now are setting quotas against the Japanese product, and 33 other countries have raised duties.

For several years now, Japan has also become a large factor in the international wool markets, for example, attaining second position as a purchaser of Australian wool. Selling, in turn, their own products in Australia, the Japanese made such good progress that the Australian Government took positive tariff and import restrictive action against Japan last May. Since then, trade relations have been very strained between these two great balancing-trade markets and unfortunately show, so far, little hope of improvement.

Japanese woollen goods already are being sold at much lower prices than British in an increasing number of neutral markets, this being only in part due to lower costs of production. A considerable factor in this price situation is the advantage which the Japanese gain by clever speculative buying. Just as they have succeeded in doing over the years with cotton, scrap iron, and other raw materials, they have been placing their wool orders in one or another of the World's wool markets very adroitly according to best price advantage. Thereby, they obtain decided economic advantage over more orthodox types of traders, and at the same time, make it easier for their trade missions to get successfully new concessions for Japanese export goods in spite of all the protests of established interests.

While Japanese silk yarns and textiles, and cotton goods conquer the world and a new woollen industry develops, one more Japanese textile industry pushes up like a mushroom—the Rayon Industry. The export of rayon offers new trade possibilities where real silk cannot be sold competitively, or where other textiles are not wanted. Japan now has the second largest rayon industry in the world, and the largest single rayon plant was, a year or so ago, officially declared in operation by his Imperial Majesty, the Emperor.

Steel and other metals and alloys, and machinery are also being produced now in Japan sufficiently to cover all domestic needs, and thereby industries are being established upon which further expanding industrialization rests. There is sure to develop certain export of such items in the near future, costs being so low.

Manufacture of electrical equipment, lamps and apparatus has developed to such proportions that these products take care of the entire domestic demand, and are now also offered abroad in considerable volume. There is no doubt that the authorities at Tokyo forecast the same future for automotive products, and products of other allied industries just now in their swaddling clothes.

More and more of world trade, and Asian trade in particular, in all manufactured items is being taken over by Japan. Mukden, Peiping, Shanghai, Canton, and even Singapore and Manila—they all are trading now more than ever, if not primarily, with Japan. Should I mention, while official Chinese Maritime Customs returns may show the United States and other European nations ahead in important categories of trade, they of course do not include or provide for goods which irregularly or otherwise find their way into China, in which it is reported there is an astoundingly increasing trade.

By cartellizing industry, by directing private and government funds into it; and by the development of all available sources in Japan and in controlled and allied territories—Chosen, Taiwan, Manchoukuo, and the South Sea Islands, Japan is attempting to solve at least the greater part of the raw material problem. Besides, Japan also is now able to produce practically all the various semi-manufactured products which previously she had to import, by developing processing industries in vertical directions.

While Japan follows internal policies entirely different from those of Soviet Russia, in reference to fundamental industrialization, there is very little difference ultimately as can be seen, for example, from the intended state control of the huge electric industries which help in saving coal and provide power, heat and light at very low rates to even the smallest mills, factories, shops and farmhouses.

In his export efforts, the Japanese manufacturer or trader does not struggle alone. The Japanese have no four or five-year plans nor any Central Planning Commission as there is in Russia. Planning and co-ordination of efforts is permanent as far as industry and foreign trade are concerned, and almost always under direct Government auspices.

Industry is not controlled but supervised by the Major Industry Law, and foreign trade is being guided by export guild organizations and policies, which in turn operate in conformance with the Export Association Law. By co-ordinating industrial and foreign trade activities of a steadily increasing number of industrial groups, by special research and analysis of all trading factors affecting individual territories everywhere, by regulation of production, price, competition, and distribution according to actual experience and most up-to-date economic information, and by closest co-operation with all available government facilities, Japanese foreign trade has developed and to-day functions as a steadily improving trade development system.

Difficulties which befall individual traders have been reduced to minimums, and usual elements of risk have been converted into relative certainty. Costly trade experimentation, in other countries met by single companies, are carried by the united industry, and individual cut-throat competition has been succeeded by export quota and price agreements. Regulations established by any of the many trade associations or export guilds are the same for members and non-members and are enforced in the specified court or before the declared arbitration board.

Restrictions of imports, high duties and other obstacles established by other nations to stem a one-sided flow of Japanese export goods apparently have so far only stimulated the technical and economic inventiveness of Japanese traders and producers, and everywhere, seasoned veterans of foreign trade are surprised by new technique which is equally as efficient as it is clever.

Thus, Japanese foreign trade is not a simple venture. It has been developed systematically, far sightedly and patiently. Modern science has been applied to all the elements which enter into foreign trade and the present boom is the result.

What will the future hold? Will the boom activity last? I think we should be importantly interested in these questions.

Weaknesses in Japan's Foreign Trade Policies

1. *General Tendencies.*—It would not be befitting this occasion nor the spirit of this meeting to criticize destructively any policy

or method which has been determined upon and is applied by our Japanese friends in their international trade.

However, in his "Call of the Convention," Mr. Farrell has stated that our task is, in part, "to survey the progress made * * * and to examine carefully the conditions now existing, with a view to the formulation of proposals for the restoration of more normal commercial intercourse between the nations of the world. The uneconomic methods of trading which many countries continue to follow, and by which the trade of the United States suffers * * * will engage the earnest attention of the Convention."

Knowing Japan as I do, and knowing the Japanese as I do, I feel that I have better grounds perhaps than most of the many critics of Japanese trade practice when I say that the Tokyo authority which establishes and assists present day Japanese trade practice does not propose its use for the purpose of "ruining" the other fellow's trade. The Japanese do not intend to offer more ruthless competition than anyone else might who might be trying to "monopolize" foreign trade.

There is, however, one feature which seems to be common to much Japanese trade practice, and as we are here to improve, if possible, mutual relationships, I might just as well state it.

The feature I have reference to is the tendency to act, perhaps a trifle too thoroughly, in measures taken to foster trade. This feature is easily demonstrable in the extraordinary Devaluation of the Yen; in lowest prices which are quoted in the world markets for Japanese export goods; in the intense promotion of production; and in debasing the quality of goods which are offered for sale. The same feature can be found also in the extensive and intensive activities of Japanese Trade Commissions who visit almost every land, and in the kind of trade promotional activity in which they engage towards establishing favor for Japan. It also appears in the form of Japanese trade-marks which too closely resemble those of producers in other countries, and in the form of Japanese articles which producers of other nationalities had thought protected in all markets by international patent law.

This tendency to be "too thorough" has been termed by some critics "overaggressiveness" and even "unscrupulousness" and there can be no doubt that it has created a good deal of animosity and adverse feeling not only in this country but very importantly, in England, and equally in many other producing and consuming countries.

Booms of any kind, promoted and forced by the application of too many economic or uneconomic, ethical or unethical stimulants, last for some time but have a tendency, as we all know, to cause difficulties sooner or later which ultimately may be more disastrous to the promoters of such booms than to those economic rivals who were temporarily left behind.

It seems that the trade boom so successfully promoted by Japanese trade interests over the past few years has serious flaws, and in the hope that it might help all around, I shall try to point out some of them.

Devaluation of the Yen.—There can be no doubt that the devaluation of the Yen, which has so greatly helped in expanding Japanese trade, was adopted only after many other financial measures had failed to correct what was considered as an undesirable internal financial situation.

However, the Yen was devalued *not ahead* of other currencies but *after* the British Pound had been devalued, and *after* the new trade situation created thereby had begun to reduce Japanese sales in the surrounding territories in which Japan was mainly interested: China and India, principally.

After devaluation had been decided upon, however, Japan, it seems, went at it too thoroughly. England appeared to be satisfied with a devaluation to approximately 70 per cent of the normal value of the Pound; but Japan kept on devaluing until the Yen was at only 41.8 per cent of its pre-war parity.

When the United States joined in the devaluation, Japan continued to keep the Yen lower than any other currency and Yens were brought down to 35.21 per cent of their pre-devaluation parity in 1934, to 34.02 per cent in 1935, and at present, the Yen is kept at only 33.74 per cent of parity (Quotation November 12, 1936—Parity \$0.843957 Actual Yen Rate \$0.2848). No other currency in the Western world or in the Far East has been devalued so much since 1929.

It has been said that the Yen, a gold currency, has been placed thereby in better relationship with most of the silver currencies used in the Orient. This, in effect, would make the exchange

of goods and funds between these countries and Japan easier, at least for the time being.

On the other hand, there can be no doubt that return to more stabilized relationships with currencies which have *not* been devalued as much as the Yen, will some day be more difficult than may be anticipated.

No one expects an early worldwide stabilization or an early return to the gold standard of all currencies; but sooner or later, some sort of currency agreement will be attempted encompassing *all* the trading nations and not only a few. Then Japan will face a serious problem.

If Japan *joins* such a stabilization move, obviously it will have to raise the value of the Yen, unless, in the meantime, Japanese costs have risen to the extent which would offset the disparity, and as a goodly portion of Japanese export has been built essentially on the basis of currency devaluation, great difficulties are sure to be encountered in maintaining present enormous export volume. There can be little doubt that if Japan agrees, it will have to suffer considerable losses in sales.

If Japan *does not join* in a final stabilization move, it will probably have to face special discrimination in many countries, such as it would undoubtedly have to face if a policy of depreciation were persisted in.

Japan's problem will be further aggravated then by higher world market prices for raw materials which will prevail if present price trends become permanent, as we have good reason to believe.

Similar in importance is the Low-Price problem!

Low Prices for Japanese Goods.—Low prices are commonly considered as favorable for sales development and thereby as conducive to mass production and large-scale industrial activity. We also know that competitive price lowering has been long established in international trade.

There seems to be, however, a limit where pricing at *too low* levels in international trade becomes not only uneconomic but produces a boomerang effect. Competitors resent it and, in many countries, this practice intensifies nationalistic feeling. Quite often, important consumption markets have been cut off suddenly and completely, and there is no assurance against similar happenings in the future.

The American Trade Mission to the Far East in 1935, under the Hon. W. Cameron-Forbes' Chairmanship, drew this fact clearly to the attention of Osaka merchants.

We know that costs of production are low in Japan—not because labor is exploited but because the cost of living is actually so much lower than in other industrial countries. We also know that other costs which enter into the total cost of any product—material, freight, and similar items—are in proportion lower than elsewhere.

What seems difficult to understand, however, is the fact that all Japanese goods are offered in international markets at prices which are so low that they represent frequently only a small fraction of the cost of other competitors.

This situation which could easily be relieved by asking higher prices has caused our Japanese friends considerable grief in quite a few countries, and still, as far as I know, no change in policy or prices is contemplated.

The tendency to underbid in this "too thorough" fashion becomes the more incomprehensible in those instances when in Japan proper and in export too, *new products* are being offered at such lowest prices which, on the face of it, could hardly cover overhead, not to speak of reserves for obsolescence, wear and tear, and provide for future expansion.

Apropos thereof, I am puzzled by the fact that Japanese truck chassis and automobiles now being introduced are offered at prices *below* those of American makes having the advantage of mass economies which, under normal trade circumstances, allow our American product to underbid the products of all other nations everywhere abroad by wide margins.

Again, while these price policies seem to be helpful in producing the present trade boom in Japan and in foreign trade, it seems doubtful if, *in the long run*, these policies will be of advantage because sales, mainly obtained on the principle of lowest price, create a definite trend towards low quality production which *must* become, sooner or later, by force of circumstances, an important feature of the industrial activity of that country.

No country as yet has found this to be economically advisable, and while export markets with low purchasing power may be tapped with low quality goods for some time, there can be no doubt

that low-quality-low-price production as a national policy has important disadvantages. It is bound to create and continue the maintenance of a low standard of living.

A tendency or trend retarding social and economic evolution may not immediately but almost assuredly will, in due time, adversely affect foreign trade. Enforced increases in wages and similar price raising influences must be expected, particularly where they are not offered voluntarily and serious social and political consequences are sure to eventuate. The past and present technical progress merely diverts attention from the real problem.

Therefore, Japan's low-price policies will show real weakness when increased foreign competition and increased social demands simultaneously bring pressure upon export producers.

The third important weakness inherent in the present boom lies in the political aspects of Japanese Foreign Trade.

There can be no doubt that Japan is still and will continue to be dependent on foreign materials and products. This implicitly means that she will have to do all in her power to maintain present exports and, if possible, to expand them.

The Political Aspects of Japanese Foreign Trade.—Some of the present export boom has been made possible if not created by military support at great expense. New territories under Japanese influence will progress, and will need a certain amount of Japanese goods, but at the same time, they will not furnish all the materials needed to support Japanese industry. However, colonies

and allied territories have a tendency to cost more than they yield and to depend increasingly on the controlling country along with political dependence.

Already, before recent territorial expansion, Japan imported more than was exported, and now has to provide for additional millions of population in these new territories for increased requirements and expenses of the army and navy; for financial outlay supporting the new highly expanded economic system; and for her own steadily increasing population—one million additional souls a year!

Will Japan try to solve her import problems by maintaining present export policies directed towards building a still larger volume of trade?

Japan has already tapped great trade areas of the Orient, of the Americas, of Europe, of Africa, of Australasia, and of the South Seas, in order to make possible the present flow of raw materials into Japan: but will these new world buyers of Japanese export goods remain permanent customers, and will they buy more in the future, thus providing funds necessary for increasing Japanese demand for raw materials and other essential items or can additional markets be approached, and will still lower prices be quoted?

I cannot answer these questions but I think that they do reveal tension which pervades the present boom. I only hope that solutions will be found to these urgent problems which will make Japan's foreign trade a benefit to Japan and desirable and useful to all.

The Chinese Railways Under the Era of General Chiang Kai-shek

By E. W. REULEAUX, Professor of Darmstadt Technical University, Adviser to the Ministry of Railways, Nanking

THE greatness of a leader is not only to be seen from his personal activities, but also from the inspirations given to his followers and the conditions created by his policy. With the Chinese National Railways under the era of General Chiang Kai-shek we have to realize both effects. From the very beginning of his influence on the development of modern China, he laid stress on the improvement of communications, especially of the railways. Remembering the genius of the late Dr. Sun Yat-sen he was and is fully aware, that a unified and effective railway system is the backbone of economic and cultural intercourse within this vast Republic, and an indispensable military requisite in order to sustain internal peace, and to defend the country against external aggressors.

A retrospection of the railway age of China will make clear the decisive change that took place, after the Generalissimo had become the political and spiritual leader of the nation, regardless of his different official posts and, of course, without neglecting the merits of those who, step by step, performed the work of progress within the recent period of Chinese Railway History. What has been achieved in the field of reconstruction in China has been made possible only on the base of political stabilization and cultural enlightenment, representing the most striking features of the evolutionary work of the Kuomintang and the National Government.

In the beginning, the construction and management of railways was hardly more than a matter of commercial enterprise. The governmental authorities refrained from any leading activities, confining themselves to administrative measures of mere licensing character. The fundamental importance of railways as means of economic, cultural and political progress had not yet been recognized. Even this attitude was preceded by one of strong opposition towards mechanical transportation. Whereas, in the rest of the world, a similar development can be stated in the early days of railway history, the following and decisive period of railway construction in China showed specific features due to her political situation. Though leading circles had become aware of what railways would mean for the country, the Imperial Government was not able to get the lead—through their own initiative—in developing modern means of communication. The foreign powers, striving for new markets in China, and recklessly competing among themselves, appeared on the scene. So, this country became the object of a *struggle for concessions*. What was constructed, did not follow a systematic railway program for opening up the country,

though sufficient experiences were available all over the world. The loans were forced upon the government more or less according to what the creditors thought beneficial to themselves. Looking back from the present day, it must be admitted, nevertheless, that most of the lines constructed in that period up to 1911, represent trunk lines which, with few modifications, would have been designed within the framework of a systematic plan. But, owing to the unsystematic procedure of those days, the lines were not built and equipped in conformity with one another, nor were they managed as a unit.

The loan agreements made them, from the very first day, separate enterprises, each pursuing its own aims, in spite of their becoming, nominally, Government Railways. The key-note of this period may be called "business" instead of what it ought to have been: "service to the country." The effect was very far-reaching and is felt even to the present day. The heavy financial losses and the technical confusion would—at least partially—have been avoided, if those first big lines had not been created under the concession system.

The ensuing period, after the revolution of 1911, until the seizure of power by the National Government in 1927, means, at large, almost a deadlock of railway development in China. On the one hand the activities of the foreign powers were checked by the Great War and the after-war-depression. On the other hand the internal troubles of China hampered any decisive progress. The existing lines severely suffered from the civil wars, and—except short periods of prosperity—the financial state of almost all lines became deplorable, approaching the verge of bankruptcy. Both road and rolling equipment were more and more worn out, to the effect that regular and effective traffic on railways was rendered almost impossible. The bondholders of the loans received neither interest nor capital redemption. So, there was no encouragement, either to domestic or to foreign capitalists, to invest their money in new railways in China. This was, at large, the state of affairs, when the National Government came into power in 1927.

The first step on the way to a better future was the establishment of a special "Ministry of Railways" in 1928. A difficult task was ahead, and it must be regarded as a good fate, that the Government found the right men to be the leaders of the new administration. Among them, Mr. Sun Fo was the organizer to start the work of central management and centralized planning. Later on Mr. Koo Meng-yu, the engineer, promoted the rehabilitation

of the main lines, so heavily damaged during the civil wars, and continued the work of technical, operative and personal renovation. The present Minister of Railways, Mr. Chang Kia-ngau, faces the immense problem of regaining both domestic and foreign credit, in order to accomplish the network of the railways as well as to modernize the existing lines.

What has been done can partly be seen from the construction work performed under the new era. Only its main achievements may be enumerated hereunder. The Canton-Hankow line, its history being more than 30 years old, has been completed by filling the gap of 456 km. between Shuichow and Chuchow. Thereby this "Chinese Central Line" is now linking the Far North to the Far South of the Republic. Rail connection at Hankow across the Yangtze either by bridge or by ferry is being designed. The latest political settlement in the South-West enables the Government to realize important railway plans, long since under consideration, in the Canton area and in the Liangkwan provinces. Far-reaching decisions have recently been made to this effect. To the Lung-Hai-line 232 km. have been added, thus providing through service from the new Chinese harbor of Haichow (opened in 1935) to Sian, capital of Shensi Province. A further section of about 180 km., as far as Paoki, is under construction and probably will be completed in 1936; the whole line is to be extended to Lanchow, capital of Kansu Province. A branch from Paoki will lead to Chengtu, capital of Szechuen Province.

Besides this important East-West line, a second one of no less importance has been started by the Chekiang-Kiangsi Railway from Hangchow to Nanchang (first section to Yushan, 336 km., completed 1933, second one to Nanchang, 300 km. inaugurated at the beginning of 1936). The next section of 300 km. is already under construction; it is to reach Pingsian within less than two years. Thus a through service from Shanghai via Hangchow, Nanchang, Chuchow and southward to Canton will be possible. But the more urgent aim is the Far West and West-South-West: Szechuen and Kweichow, both provinces lacking any railway communication up to the present day. So, a Chuchow-Kweiyang-Chungking and a Chungking-Chengtu line are being surveyed; the former is probably to be extended towards Yunnan later on. Negotiations for providing the capital for all these new lines are on the way.—The immense value of these projects stretching the railroad into remote provinces, long neglected in their economic and cultural development, cannot be overestimated.

We turn to the regions nearer to the ocean and find new links there. The Kiangnan Railway, connected to the Nanking-Shanghai Railway east of Nanking, leads via Wuhu to Sunchiapu (188 km.): its southeasterly extension is being constructed and will, later on, become a main line through Chekiang and Fukien to Kwangtung. In North Anhwei the Hwai-Nan Railway has been created for the transportation of coal and agricultural products to the Yangtze at Yuchikou, opposite Wuhu (200 km.) In Kiangsu the busy centers of Soochow (now Wuhsien) and Kashing have directly been connected by a new line of 74 km. shortening the distance via Shanghai by more than 100 km. and opening the fertile district east of the Tai-Hu. Among light railways the partly completed Tung-Pu line of one meter gauge, about 800 km. in length goes from North to South through Shansi Province; it is a provincial enterprise linked to the Government Chengtai line at Tayuanfu.

Last, but not least, we call attention to special construction for overcoming river-barriers that, up to now, interrupted rail-service. The train-ferry between Nanking and Pukow affords through passenger and goods traffic between Shanghai and the North since 1933. A double-deck railway and highway bridge across the Chientang River near Hangchow is under construction. It will link up the Nanking-Shanghai-Hangchow system to the Ningpo, Kiangsi and Western China lines. The bridge will have a length of 1,500 m. and represents a marvellous engineering work.

Summing up, we find that since 1928 more than 1,800 km. of new lines of standard gauge have been opened to traffic. Further 700 km. will be completed within one or two years, and more than 3,000 km. are being surveyed or seriously planned for the near future. Considering the financial situation of the country this result must be highly appreciated. It is worth mentioning, though of minor importance, that part of the new lines in Eastern China are not purely Government Railways, but enterprises under the auspices of different authorities or corporations. Encouragement to build them was derived only from the conditions created by the National Government.

Now, the actual length of railway lines completed, under construction or under survey represents only one side of the present and future activities of the new era. There has been much work of repair and internal rehabilitation to the existing lines. But there is one more topic of utmost importance from the standpoint of political and economic recovery: it is the abolition of the former "concession system." The new railways of China are no more objects of one-sided exploitation. They have been and will be created as "tools in the hands of the Government," after free and independent deliberations from the economic, financial, technical and military points of view. Though foreign capital is still necessary for the reconstruction of China, the National Government, to-day, is in the position of "accepting" loans which are "offered" to them. The new agreements will be of pure economic character and free of any political interference. The principle of equal rights of both partners is being acknowledged, which will be to the benefit of both of them. A sincere review of the past unsatisfactory development surely would prove, that the methods of "enforcing" railways in China was a most unfortunate one for all those entangled in that harmful epoch.

The progress of railway construction and management, shortly outlined in this article, is due to the internal consolidation of the country under the National Government. All of us know that still more hard work for the rehabilitation of the Chinese railways is ahead. The damages of the civil wars and the subsequent financial breakdown have not yet been cured, and many difficult problems are still to be solved, as organization, centralized operation, remodeling of the workshops, standardization of the rolling stock, education of the personnel and others. Not all of them will be "for show," nor do they represent indispensable conditions for a real and permanent recovery.

It is the *spirit* of the present leader of China that has shown the way and that will do it in the future. His example of never-tiring arduous work—sometimes not visible to the outside spectator—is, in the eyes of the Chinese people and of all true friends of China, the warrant of a prosperous future of this country—and its railways.

Huge Loan Made for Szechuen Railway

A loan has been concluded by the China Development Finance Corporation, acting on behalf of the Chuan Chien (Szechuen-Kweichow) Railway Company, with the Banque Franco-Chinoise pour le Commerce et l'Industrie, acting on behalf of a French Syndicate, for the construction of a railway between Chengtu and Chungking.

The projected Chengtu-Chungking Railway covers a distance of 523 kilometers, traversing what is known to be the richest part of Szechuen, and is expected to be constructed in two and a half years. The estimated cost of construction is in the neighborhood of \$54,500,000; \$20,000,000 of which will be furnished by the Chuan Chien Railway Company, and the balance of \$34,500,000 by the French Syndicate, to be redeemed in 15 years. Of the loan furnished by the French Syndicate, \$27,500,000 will be in material and freight to Chungking, and \$7,000,000 in cash. The loan is guaranteed unconditionally by the Ministry of Railways.

The Chuan Chien Railway Company was formed under a special charter granted by the Executive Yuan on March 21 this year, with an initial capital of \$20,000,000. Of the total capital, \$11,000,000 is composed of private capital underwritten by the China Development Finance Corporation; \$4,500,000 is subscribed by the Ministry of Railways; and \$4,500,000 by the Szechuen Provincial Government.

The enterprise marks a new and radical departure from previous railway construction in China. In the first place, the railway will be operated as an entirely private company with integral freedom of action, but at the same time with government assistance as and when required. It is also understood that when market conditions allow, the government holdings in the company may be sold to private investors.

Secondly, for the first time in many years, foreign assistance in railway construction will compose of a substantial amount of cash as well as the supply of materials for a long term of years.

Thirdly, the construction, operation and management of the railway and purchase of supplies, will be under Chinese control. The Loan Agreement provides for two French experts to furnish technical assistance.

Finally, the China Development Finance Corporation has been appointed by the French Syndicate as the sole trustee for the loan.

The Growth of Greater Shanghai

THE original conception of developing a new, modern and integral Chinese city near the International Settlement of Shanghai, and to include in the development facilities for a new and much-needed modern down-river port, is not new, as might be believed, but dates back more than thirty years. As with many projects in China, the plans simmered for many years until they were revived by General Chang Chun, Foreign Minister and then Mayor of Greater Shanghai, who, in July 1929, appointed a committee to take charge of the project.

The "City Planning Commission" of Greater Shanghai was the result and consisted of eleven technical experts, headed by Dr. Shen Yi, most of whom to-day retain their original posts and are continuing their efforts so that the entire unique project, indeed a landmark in scientific civic planning in China, will shortly be completed. Dr. Shen is the former Commissioner of Works of the City Government, is a German-returned student, and is assisted and advised by two well-known American experts, and one German specialist in civic planning and reconstruction.

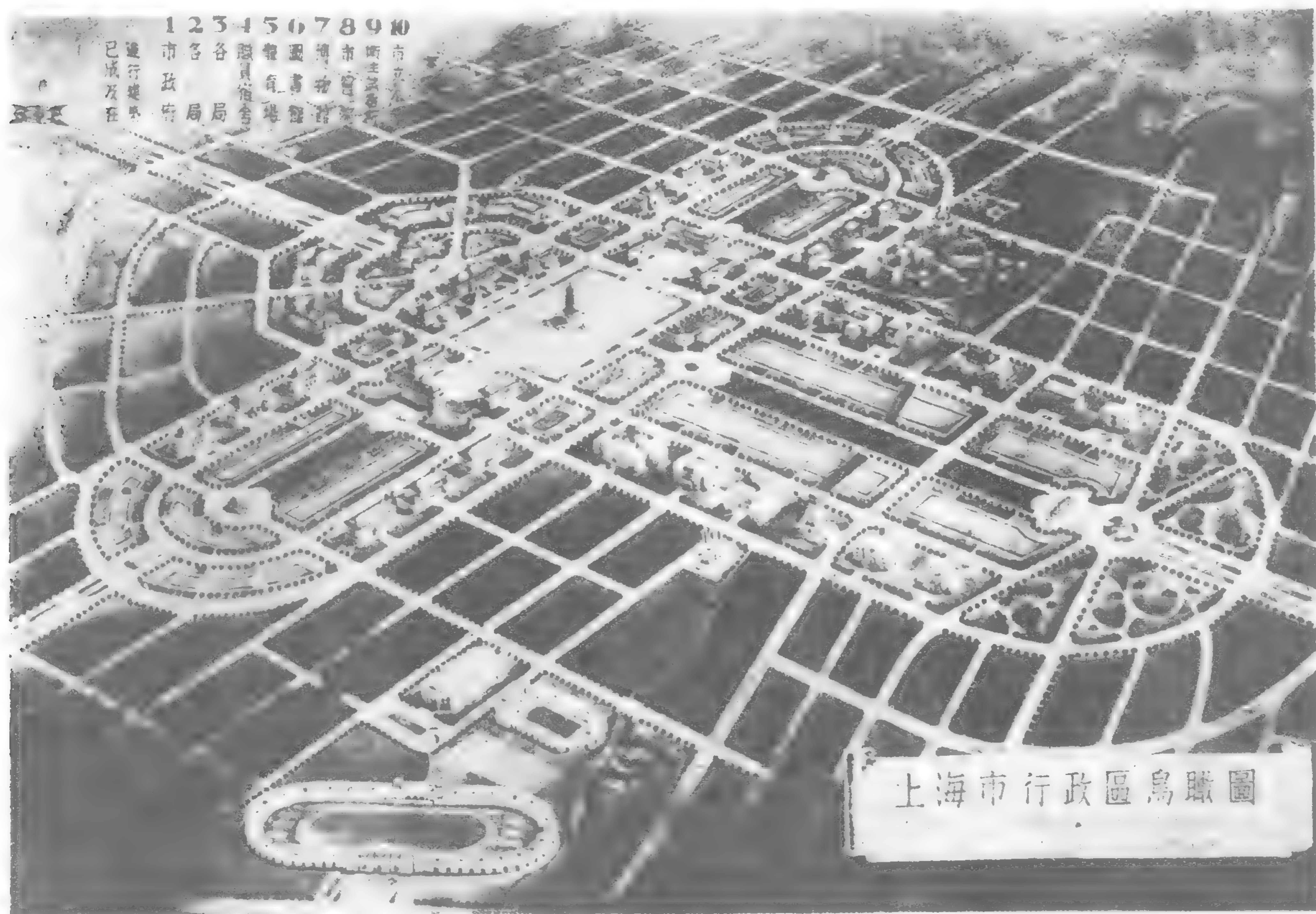
The site chosen for this project was the Kiangwan district, conveniently located between Woosung and the International Settlement, bounded on the east by the Whangpoo River, on the west by the Shanghai-Woosung Railway, by Woosung village on the north, and by the International Settlement on the south. Out of this one-time rural area, where even two or three years ago stood an unbroken expanse of farmland, the city-builders have erected many modern, attractive-looking buildings expertly landscaped, now known as the "Civic Center."

In planning this new city, the designers observed that the district was centered at the intersection of two cross axes: the east and west axis being a sixty-meter wide boulevard from the new North-railway station to the Whangpoo River, the north and south axis being also a sixty-meter boulevard running north and south to form the main approach from the present International Settlement.

Entire Area Zoned

The entire area was zoned, with provisions for a business district, a manufacturing district and a residential area, though in the present case the form of these areas does not approximate that of a series of belts or zones. Now and then the "zoning" may be on lines as in some German and American towns, where the gradual increase starts from the center and proceeds towards the environs. But in the case of Shanghai, the character and the suitability of the ground clearly indicates the use to which it is assigned. Although it is impossible to predict with accuracy what the future development will be, the new plan provides, as far as possible, for future requirements, including hospitals, schools and recreation centers. Unlike old-style Chinese cities, the Civic Center includes breathing spaces. No less than 15 per cent of the total area is earmarked for parks. The first park on the bank of Jukong Creek has already been well planted.

The center is surrounded by business and residential areas. Parks and open spaces are well cared for along the Whangpoo River. To the north is the harbor district and to the north-west is the



The Civic Center of Greater Shanghai. Buildings completed are: Municipal Administration Building, temporary quarters of Bureau of Public Utilities and Public Works, temporary quarters of Bureau of Social Welfare and Public Health, Dormitory for Members of Staff, Sports Center, Library, Museum, Municipal Hospital, Laboratory and Municipal Primary School



Map showing Foreign Settlements and north of them Civic Center and portion of Greater Shanghai

industrial quarter with the northwestern wind carrying the smoke and dust away from the main city.

The road system plans were made public in 1930 and revised in 1932. Since then, it has been partly carried out. The system is so planned as to relieve congestion of traffic along the main arteries. The roads, radiating out from the center, are wide, hard-surfaced, lined with young trees, and well policed by uniformed traffic officers. The five main arteries are designed to direct the free flow of traffic north and south, and were completed before October 1931. Outstanding among these roads are Chimei Road, Huang Hsin Road, Hsiang Road, San Min Road, Wu Chuan Road, and Zaying Road.

Most growing cities suffer from narrow streets. The Civic Center plan makes adequate provision for this deficiency by fixing the width of sixty meters for main trunk roads, thirty meters for boulevards, twenty-five meters for ordinary thoroughfares, and twenty meters for small streets.

The streets are so planned that they intersect at right angles. Regarding the orientation of the street blocks, a rule has been observed. The blocks will run east and west, so that the buildings will face either north or south. In this way the intense summer heat may be mitigated. The dimensions of the average block is determined by reasonable economical size. In the residential district, ring streets or circumferential streets were introduced. This has not only been done for the picturesque effect but mainly to reduce through traffic in order to keep the residential quarter quiet. Open public spaces are provided at the intersections of principal streets for the double purpose of relieving the traffic and to add beauty to the monotonous long thoroughfares.

Two Cross Axes

As above mentioned, the center of the new city, taking the shape of a cross, is situated at the intersection of two cross-axes: the east and west axis is represented by a two hundred feet wide, three-tracked boulevard, known as San Min Road, which means "Three Principals," to the west of the center, and the Wu Chan Road, translated "Five Rights," to the east. The north and south axis is represented by another two hundred feet boulevard, named, Sze Chai Road ("World") to the north, and the Ta Tung Road (universal) to the south of the center.

The center of these axes, called "The Center of Shanghai," is marked by a 165 feet Pagoda which can be seen from all directions and from the top of which the entire newly built area can be overlooked.

Hitherto 15 kilometers of asphalt roads, 10 kilometers of macadam and 15 kilometers of cinder roads were completed. The supply of asphalt, macadam and cinder is furnished by a newly established municipal factory which produces satisfactory results, especially the asphalt won popularity for its durability. Also a sewer pipe concern was founded. Though simply equipped, the factory turns out good products, and installed up to now a sewerage pipe of 40 kilometers in length and from 30 to 90 centimeters in diameter.

The land policy of the Kuomintang is now being tried out in the new Civic Center. Immediately after the announcement of the new plan, large tracts of land were purchased for the construction of the roads, parks and other structures for public purposes, while the remainder was sold, the proceeds being set aside for further development of the administrative center. A total of more than 1,400 mow of land were sold during the first and second sales which took place in 1930. The third public sale was held in the beginning of 1934. A sum of about \$3,000,000 has been gained from this source. To administer this fund, which is destined for further construction,

a committee representing the new landowners was set up.

Building construction began with an open competition in 1929 at the conclusion of which Dayu Doon, an American educated architect and official adviser to the City Planning Commission, was appointed chief architect in order to study, elaborate and detail the selected plans. A contract for the Mayor's building was awarded and the construction, which marked the beginning of the building program, was immediately begun.



Outline map showing symmetrical manner in which roads of Civic Centre area are laid out

The Mayor's building was erected in the center of the whole district, 500 feet north from already mentioned Pagoda, flanked by eight other buildings sheltering the eight bureaux of the City Government. The construction was completed and the building dedicated in the spring of 1934. It is a solid and substantial structure combining a white marble base, tile roofs, and a colorful exterior of the Peiping Palaces with the requirements of a modern office building. Mayor Wu Te-chen and his departmental assistants have their headquarters there.

Broad Streets Provide Vistas

Where a city occupies level ground, monumental buildings can only be seen to advantage if they are approached by streets of adequate width and length affording them a view from a distance. Therefore about 1,000 mow (approximately 170 acres) of ground are reserved for this purpose. About 120 mow are devoted to a plaza where public meetings and reviews can be held. A huge reflecting pool, about 2,000 feet long with impressive boulevards on both sides mark the southern approach, two smaller pools are situated similarly to mark the eastern and western approaches.

Immediately behind the Mayor's building rises the great roof of the Municipal auditorium, which has a capacity of 3,000 persons. Clustered around the cross are the library, museum, art gallery, court houses, and other public or semi-public buildings.

The museum stands on a site measuring 350 feet by 550 feet, bordered by streets. It is two-storied except the central portion which rises above the rest of the structure and is surmounted by a "gate tower" modelled after the Peiping style. The plan provides for future extension. The exterior design, simple and dignified, combines traditional Chinese architecture with modern requirements. The wall is faced with artificial granite, giving an impression of solidity and durability. The entrance arches are decorated with conventional Chinese carving. Windows appear only on the lower floor. The "gate tower" has sixteen columns in bright vermilion. The beams and eaves are profusely decorated with colors and patterns. The double roof above is covered with yellow glazed tiles, which in the old days were permitted only on the Imperial palaces. The open terrace around the "gate tower" is highly carved with balustrades. The building can be immediately recognized, with its windowless walls and glass-topped skylights it cannot be anything but a museum.

The Library

The library with its tall windows for reading-rooms and slit windows for the stack room, clearly indicates its nature. It stands together with the museum, facing each other to the south of the group of Government buildings, on a site measuring 350 feet by 550 feet bordered on all sides by well-paved streets. Quite similar to the plan and appearance of the museum, it follows the general principle of providing for adequate housing of books. The approach to the building is arranged in the same manner as with the museum; that is, a forecourt formed by the main facade and the projecting wings. Well over the main entrance are six huge bronze letters signifying "City Library of Shanghai." A pair



Gen. Wu Teh-chen, Mayor of Greater Shanghai

of bronze lamps decorated with dragons stand on each side of the entrance doors which are executed in the conventional Chinese design.

Soon after the main administration buildings were completed work was begun on the three units of the athletic grounds, the stadium, the gymnasium, and the swimming pool. Constructed at a cost of \$1,150,000 the Sports Center was completed in the autumn of 1935. Other structures, such as the tennis stadium, and the baseball park, will complete the group in the near future.

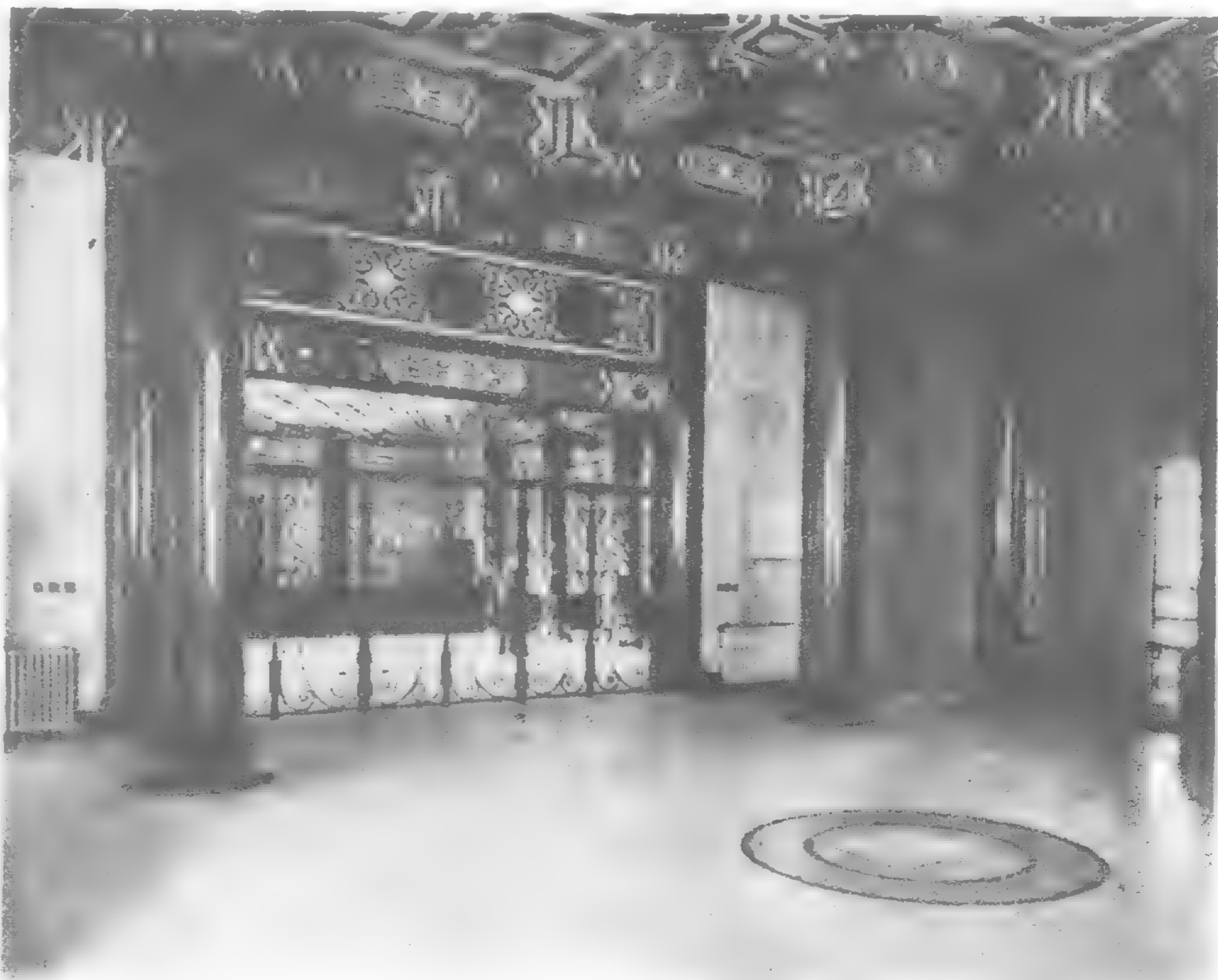
Shanghai Sports Center

Greater Shanghai's sports center is very favorably located at the intersection of four main roads, thus accessible from all directions, and is spread over an area of about 300 mow (50 acres). The architecture is Chinese in character but in line with modern construction. The whole group is centered by the stadium, which has a seating capacity for 70,000 persons, but the sketch provides a future extension to accommodate additional 30,000 seats. It is primarily designed for track-and-field events. It has a football-field in the center and tennis and basketball courts at the ends. The oval track measures 500 meters with a 200 meter straight track on each long side. In most cases, maximum standard dimensions are adopted. The tracks are

covered with cinders and the rest of the area with turf.

There is a magnificent entrance gate, great concourse, press stands, radio broadcasting station, dining-room, etc. Two grandstands are opposite one another and have seats for special guests and members of the press.

The reinforced concrete structure is made of red brick with artificial stone for the base. The main feature of the stadium centers around the main entrance which is made entirely of precast artificial stone with Chinese architectural motives. The rest of the structure is plain and simple.



An interior view of the City Library showing elaborate designs

The next of the athletic group is the open-air swimming pool. It is surrounded on all sides by four stands seating a total of 5,000 persons, with club and service quarters. An imposing portal encloses the south end of the pool with space for administration, lounges, trophy rooms, ticket offices, etc. A covered passage runs around the structure to shelter spectators in case of rain. A small pool for the benefit of children is attached with a depth of $2\frac{1}{2}$ feet.

The dimensions of the pool is 20 meters by 50 meters (65-ft. 7-in. by 165-ft.) the metric system is used because of its popularity in all athletic contests in China. It has a spoon shaped bottom, which is gradually sloping to the middle of the total length, beyond which point it is sloped both ways to a maximum depth of 15 feet from the deep end. The shallow end has a depth of four feet, the middle point six feet and the deepest point 11 feet, six inches. The above depths are required by the rules of the Far Eastern Olympic Games.

The pool is of reinforced concrete shell construction with thorough waterproofing. The shell is designed both to withstand unbalanced hydraulic pressure when the pool is full of water as well as earth pressure from outside when the pool is empty. Over 700 wooden piles were used for the bottom of the pool. The curb and the bottom are made of white enamelled tiles.

The most important part of the pool is the filtering plant. The pool requires 600,000 gallons of water. Frequent change of water means expense. Ten hours are required to make the change. Furthermore, the fill-and-empty method is no longer used in modern public pools. The water should be treated chemically and be kept constantly clean. Therefore, a filter system is used. The water goes through a cycle of five operations: (1) sterilized,



Front portion of the Administration Building in which modern architectural construction has been combined with the traditional features of Chinese buildings



Another view of the Administration Building

(2) filtered, (3) enters the pool, (4) circulates, and (5) leaves the pool. This cycle may be continued throughout the swimming season. It is claimed that the successive sterilization and filtering makes the water purer at the end of each cycle which is completed at the end of every six hours.

The entrance facade of the swimming pool is of precast artificial stone with carvings, the character distinctly Chinese. The general architectural character is like the stadium.

Huge Gymnasium

The gymnasium concludes the sports group. With a seating capacity for 3,500 persons, its main floor measures 131 by 76 feet, which is large enough to accommodate three basketball courts laid out side by side. The highest point of the ceiling is 63 feet from the main floor. The over-all length of the building is 270 feet, while its over-all width is 150 feet.

It is constructed of structural steel and reinforced concrete. Wood is used only for the main floor and the doors. The building has enclosing walls of precast artificial stone coping and base. The end walls, 66 feet high, terminate in a segmental arch. The side walls are 40 feet high. The segmental roof is supported by three hinged arch trusses, spaced 22 feet apart. The large trusses which carry the roof have a pin point span of 149 feet and vertical dimensions from bottom pin to top pin of 64 feet. The radii of the curvature of the chords are 99 feet for the upper. The back post of the trusses is vertical to a height of about 41 feet above the lower pin. Enclosing the main floor are concrete stands extended from the sidewalls, about 36 feet. The main floor is covered with maple wood.



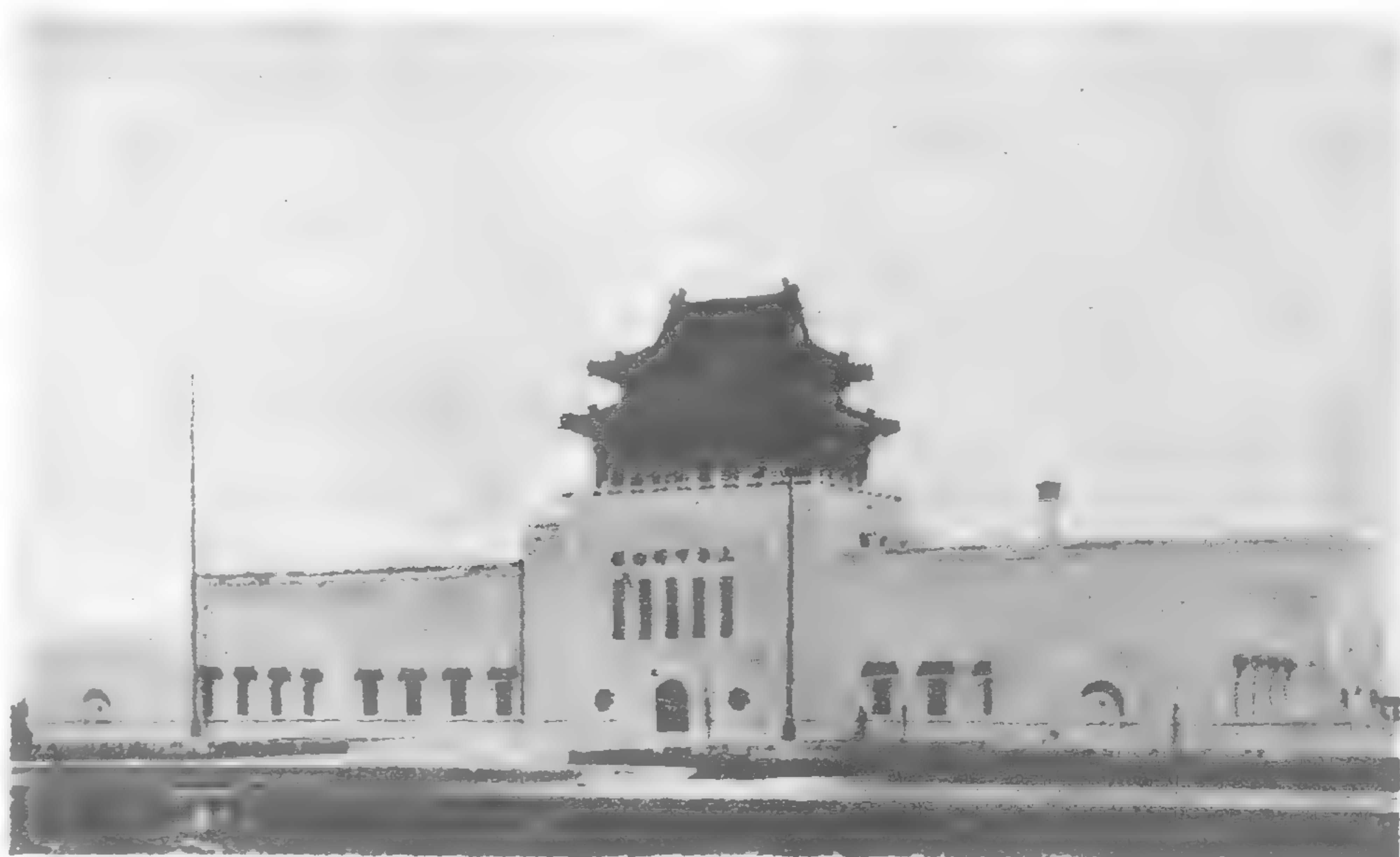
Photo taken on road in Civic Centre on occasion of a mass wedding ceremony

Water and Electricity

The elaborate efforts of the Chapei Electricity and Waterworks Company, as well as the Shanghai Telephone Company, resulted in the Civic Center's being well equipped at this time with water, power and a modern up-to-date telephone service.

Even though much has been achieved, so far, through the never-resting efforts of the City Planning Commission, whose members consult and discuss new plans at fortnightly meetings, they believe themselves still far from their goal. The plan the commission is engaged with at present is the question of an around-the-city railway. The existing railway connection with the Civic Center was effected by the extension of the Shanghai-Woosung line and was opened to traffic on October 10, 1935. Since then, certain modifications are planned, which will connect the Civic Center with a net-work of railway lines. Chen-Ju, a small town, north-east of the International Settlement, will be made a railway-junction, from which four lines will branch out. To the east all passenger trains will be brought into the new grand terminal, at the west end of the east-and-west axis of the city (San Min Road): to the west will be the Shanghai-Nanking line: to the north the Shanghai-Woosung line (connecting with the gauges of the Jukong wharf): and to the south will be the Lung-Hwa station and the Shanghai-Hangchow line. It is evident that with this railway system the future development of Shanghai may be assured.

One significant feature of this city of the future is the provision made regarding trans-



Front view of the City Museum



Front view of the City Library

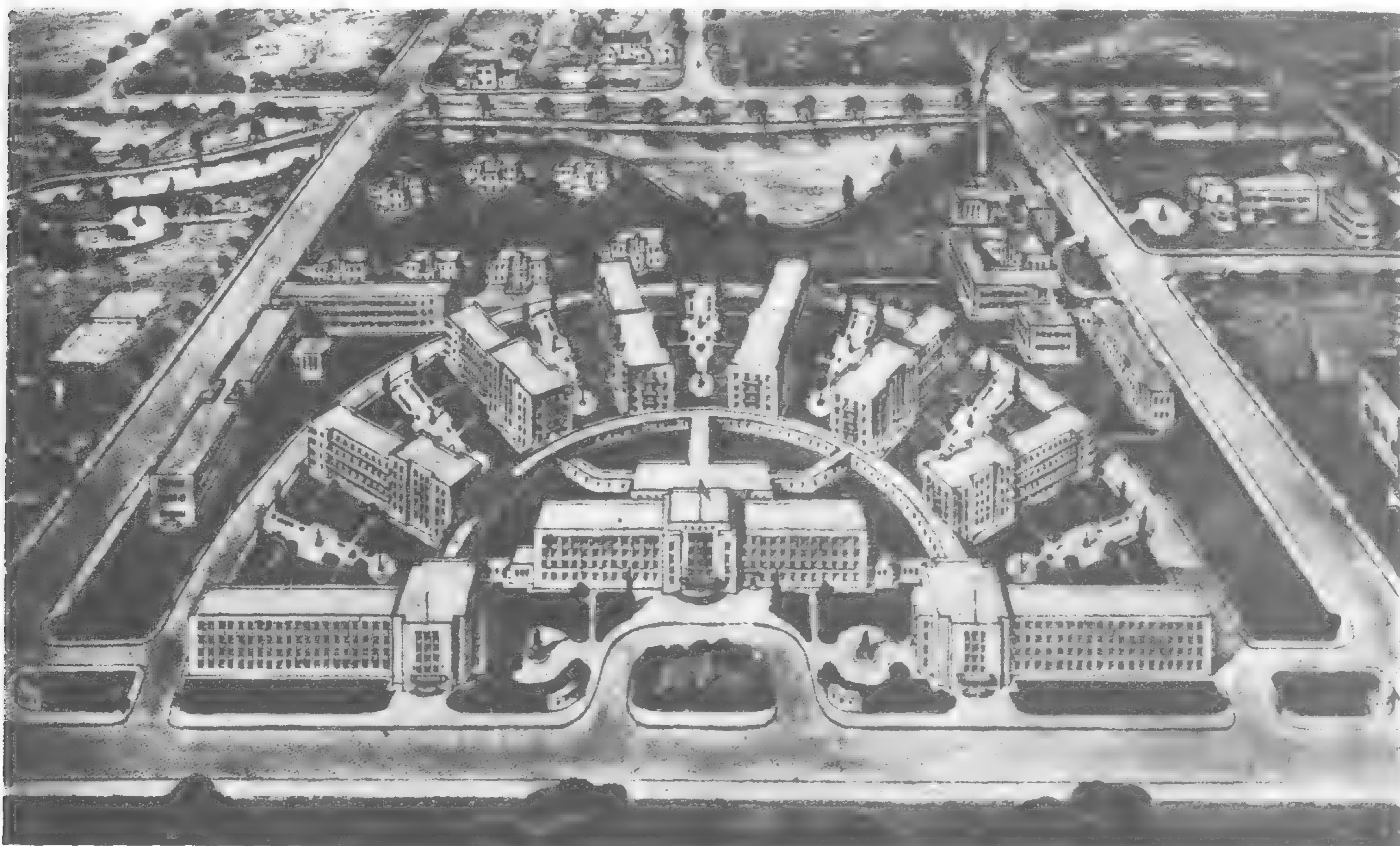
portation. The present city of Shanghai is located not on the Yangtze River, but on the Whangpoo, some fourteen miles from the Yangtze. The Whangpoo is a sluggish stream, the bed of which must be dredged constantly in order to permit deep-sea liners to enter the port. Rather than risk the dangerous ascent of the Whangpoo the Canadian-Pacific passenger ships, until a few years ago, anchored in the Yangtze and sent both freight and passengers up to Shanghai on launches and lighters. As a further handicap to commerce, the rail-

ways in Shanghai (Settlement and French Concession) nowhere touch the docks at which ocean-going ships load and unload their cargoes. The docks are located chiefly in the International Settlement or across the river on the Pootung side, while the railways are entirely on territory controlled by the Chinese. The committee now plans the construction of a deep sea port, close to the mouth of the Whangpoo, where the railways will come directly down to the docks. The completion of the new port, located only a short distance from the Yangtze, will make it unnecessary for ocean-going vessels to thread their way up the tortuous channel to Shanghai. The first units of the new port will be completed next year.

Nor have the masses been forgotten by the City Planning Commission. Already blocks of houses, suitable for workmen and their families, are being built with municipal funds. Unlike the dark hovels, in which most Chinese factory workers now live, the new structures will have light, space and some measure of sanitation. Interesting likewise is the provision of governing these little communities by means of their own elders. Thus the traditional Chinese aptitude for



View of the rear portion of the Administration Building, showing its graceful composition



Architect's drawing of the Greater Shanghai medical center as it is to appear in future. The first units, in center, the City Hospital and the Pathological Laboratory are completed

local control and self-government is being adapted to the requirements of metropolitan life under modern conditions.

Medical Centre

A visitor to the new Civic Center, walking down the Jukong River, may, incidentally, find himself confronted with two newly erected buildings, standing lonely on the north side of a lot comprising eighty mow of land bounded by the Jukong River on the south and main streets on the other sides. Inquiries will soon give him the information that these buildings are the temporary results of a huge project for better hospital facilities in Greater Shanghai, pushed forward by the City Government. Upon learning of the whole scheme to be worked out in the future, one cannot help admiring the initiators of this ambitious program, which is destined even to excel the latest acquisitions in the field of modern hospital and health facilities linked with medical education, such as the P.U.M.C. in Peiping, and other modern projects in China.

The proposed Medical Center, to serve a major portion of Shanghai's 3,700,000 population, and thereby answering a long-felt need, will be the first up-to-date well equip-

ped co-ordination of hospital and health service combined with a medical school built by the city. It is to include nine principal buildings: two medical units, two surgical units, one for gynecology and obstetrics, one for out-patients which is to include ear, nose, throat and eye departments, and a nurses' school and home. Besides these buildings, residential and service quarters are to be provided. As the buildings should be grouped so that they form one unit, although each of them functioning independently, the fan-shaped plan has been adopted from various plans submitted, which, aside from its picturesque effect and good communication, has one very important merit. It gives the maximum amount of air and sunshine to all sides of the radiating buildings.

The Administration building will be located in the center, flanked by out-patient department and nurses' school facing the north side of the compound. Six ward buildings radiate to the south from the Administration building. Each of them has its long side facing, respectively, east and west with the south side reserved for the day-room.

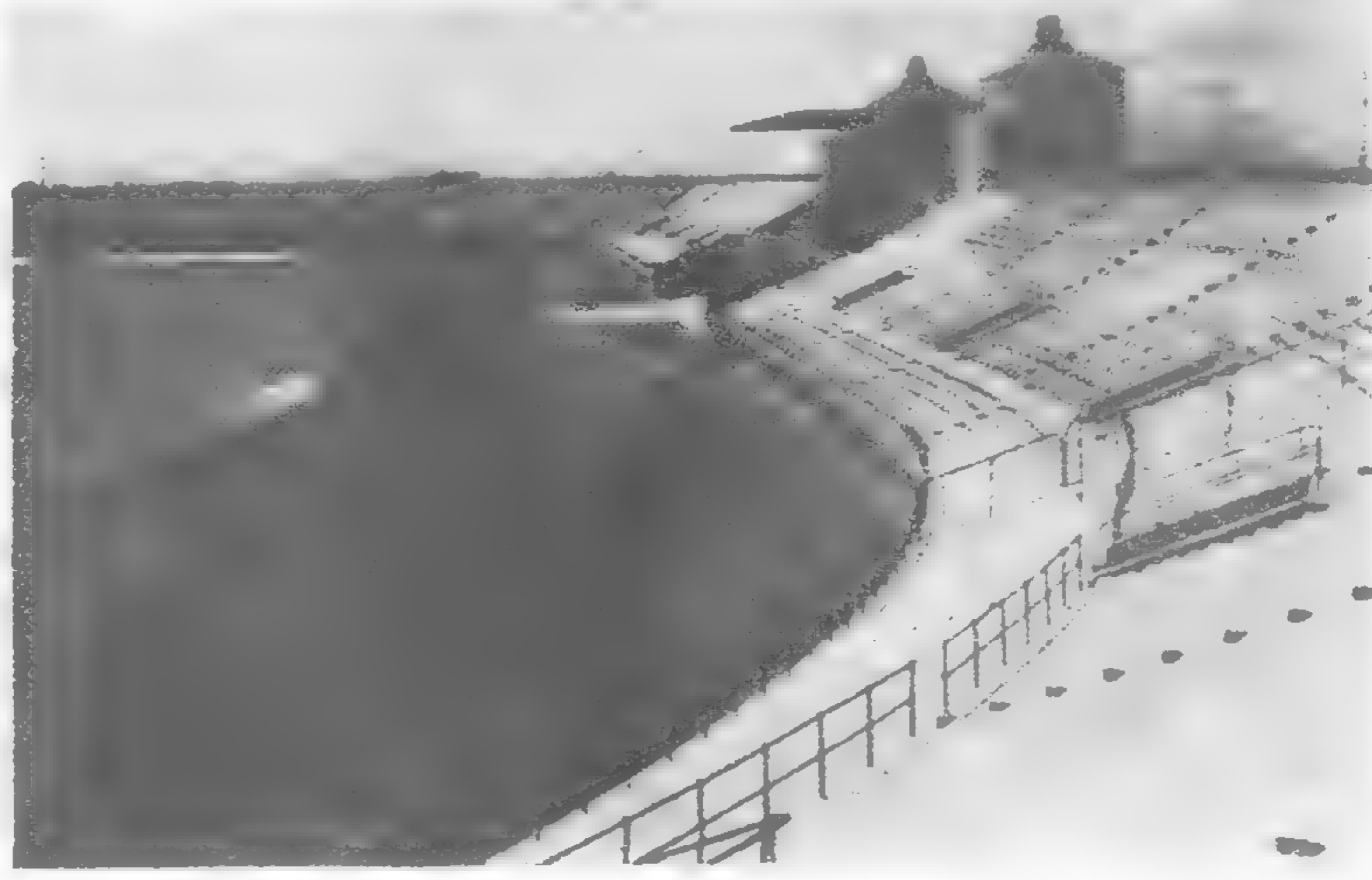
The area between buildings will be used for gardens in which the convalescent patients may take a stroll or be wheeled around. The residential quarter is provided for at the south-east corner while provisions for the service quarter are made



Front portion of Airplane-shaped building which houses the China National Aviation League. The Museum is seen at left



Entrance to Greater Shanghai's Athletic Stadium



Interior view of the Stadium

at the south-west corner. As the prevailing wind travels in a south-easterly or north-westerly direction, smoke nuisance may be eliminated.

General Hospital Open

The two buildings the visitor is confronted with are the future Administration building and the pathological laboratory. The first one will be used for the present as a general hospital. It measures 277 feet in length and 53 feet in width, occupying an area of about 12,000 square feet. Being four-storied, its central portion is raised two stories higher. The approximate volume amounts to 555,000 cubic feet. A total floor area of about 49,000 square feet is estimated to be occupied. Accommodations for 150 beds ordinarily and 50 more in case of emergency are provided.

The exterior is a straightforward expression of the plan designed in a free adaptation of the modern style with decorations of Chinese motives. The building conforms in character with the other

public buildings already erected at the Civic Center, except that it has no glazed tile roof, which is not suitable for a hospital, because of the extra cost and the waste of space under the roof. But the construction has, nevertheless, a Chinese character and conforms most essentially with the requirements of a modern hospital.

Artificial stone exterior walls cover the reinforced concrete construction. Walls along the corridors are of hollow tile. Because of the fact that it may be easily removed and re-arranged without much damage to the building, wooden lath is used for the rest of the interior portions. The wards have asphalt tile floors and the elevator halls are equipped with terrazzo floors as well as the operating rooms and other utility rooms. All doors to the wards are made four feet wide and the corridors eight feet wide, to allow free movements of beds.

The basement floor contains rooms for boilers, electric switches, and other mechanical equipments.

The main and side entrances are located on the ground floor, as well as the administrative offices.



View of the interior of the Stadium on occasion of a recent sports meeting



The City Pathological Laboratory



The newly completed City Hospital

X-ray and private patients department reception room, visitors' room, information desk, and pharmacy. Rooms for admission, examination and emergency treatment are also found on this floor.

The first floor is devoted to surgical department and operation. Male patients occupy the wards in the east wing while the female patients occupy the west wing. Each section has its own utility rooms such as the serving kitchen, the linen room, the nurses' station, bathrooms and toilets. Private rooms and smaller wards each are also provided. The general wards are planned to contain five to ten beds. Adjacent to the elevator lobby are a small classroom and laboratory on the north side, and a day-room with large window and sun balcony on the south side. Special attention was given to the construction of the operation rooms which, for economy, are arranged in pairs, all facing south. The walls and ceiling of each operation room are lined with greenish-blue glazed tile. Smaller accessory rooms are located on the north side.

The children's department and the maternity wards occupy the second floor. Cubicled wards and isolation suites are provided for the children in the east wing. The west wing is assigned for maternity wards with labor and delivery rooms, whose construction is similar to the operation rooms as described above. The infants' room, the incubator room for the premature and other accessory rooms complete the arrangement of the second floor.

The lay-out of the fourth floor is quite similar to that of the second floor; only this floor is devoted to the medical department for men and women.

The fourth floor is a tower-like feature used for the kitchen. Coal and food stuff are carried up from the basement by the service lift in the basement. Over the kitchen is a well ventilated skylight. Cooked food is distributed to the serving kitchen on each floor by means of two electric dumb-waiters.

A special feature of the building is the installation of the Dunham differential heating system which is designed and operated automatically to change the temperature to meet the requirements in the radiator according to the outside temperature.

Pathological Laboratory

The next building already completed to form the medical center is the pathological laboratory. It is situated east of the

future administrative building opening to the same street. About fifteen mows of land were required for the purpose of establishing this modern laboratory with all necessary equipment.

The building is three storied and has an overall dimension of 134 feet by 49 feet. Its approximate volume is 220,000 square feet. The total floor area is 20,000 square feet. The structure is of reinforced concrete with a style similar to that of the hospital.

The main entrance is situated in the center facing the street to the north. On either sides of the entrance hall is a corridor extending the full length of the building. A stair in the hall leads to the various floors and the roof. On this floor are located the information office, reception room, doctors' locker room, directors' room, library, offices, materials room, cleaning room, and rooms for steam and dry heat sterilization.

The second floor has laboratories for vaccine, smallpox vaccine, and rabies vaccine. There are also rooms for bacteriological research, incubator, and dissecting room, etc.

The third floor is assigned for chemistry laboratories, rooms for balance, science, materia medica, and pathological research. A museum and a lecture hall completes the arrangement of the third floor.

The building is equipped with gas, compressed air, vacuum, high voltage, direct and alternating current, high pressure steam, and electric refrigerators.

Besides the main building there are several accessory buildings and a dormitory for the staff.

With its population steadily approaching the mark of 4,000,000, the hospital facilities of Shanghai, even now unable to adequately meet normal demands, will be greatly strained. The completion of the Civic Center hospital and medical group, however, will at last provide urgently-needed facilities and will make planned public health service in Greater Shanghai, a service which is based upon serving the greatest number of people at the most reasonable of costs, a reality. The Civic Center and its medical group will stand as eloquent testimony that reconstruction and rebuilding is quietly but definitely proceeding. And the medical group will stand as proof that this reconstruction is based on a program destined to serve the greatest number possible of the Chinese masses. A program so based is bound to succeed.

International House Planned for Tokyo

(Translated from the "Tokyo Asahi Shimbun")

THE International House, an institution for the benefit of students all over the world, organized by Mr. Harry Edmonds with the generous assistance of the Rockefeller Foundation, is already a proud possession of four cities, namely: New York, Chicago, Berkeley and Paris. As reported last spring, the Japanese authorities in conjunction with Mr. Edmonds started to work out a general plan to erect an International House in Tokyo, as a joint undertaking of America and Japan and a forerunner of this kind of institution in the Far East.

Prof. K. Takayanagi, in charge of the Tokyo Imperial University library, was entrusted with the mission to talk the proposition over with Mr. Edmonds in the States, when he was acting as a Japanese delegate to the Institute of Pacific Relations Conference at Yosemite. Consequent to their discussion, it has now been decided that these two countries will jointly put up an International House in Tokyo commensurate to the specific circumstances obtaining in the Japanese capital. Some time in March next year, Mr. Edmonds is expected to visit Japan on a tour of inspection, and actual construction work will be taken in hand before next summer is over, subsequent to selection of site, architectural plans, and so forth. Just back home from the States, Prof. Takayanagi is about to make a formal report to the Japanese authorities. Thus realization of the International House scheme seems to be assured for the near future.

The idea of International House was initiated by Mr. Edmonds 26 years ago, when he encountered a Chinese student lying sick on the roadside in New York City. This led him to prevail on Mr. and Mrs. Rockefeller to provide young alien scholars with dormitory accommodation. Because of the comparatively small number

of foreign students in Japan, the very reason for the existence of an International House becomes rather tenuous, if it is erected on that score alone. As a matter of fact, the repeated interviews between Mr. Edmonds and Prof. Takayanagi resulted in an agreement that Tokyo's International House shall form, not only a research center of Oriental cultures for foreign students, but also a laboratory of studies for Japanese students of international cultures.

The erection cost of the Tokyo International House will run to between Y. 5,000,000 and 10,000,000, giving accommodation to several hundred foreign students in the shape of living quarters, lecture halls, dining-rooms, library and the like. In addition, there is to be provided enough floor space to merge in this house the various internationally active organizations in existence at the present time. Its ambitious scheme is that, in order to promote cultural co-operation, there will be something like 60 invitations annually sent specially to professors, assistant professors and others of the various universities, both in America and Europe. Mutual appreciation is aimed at by this exchange of the oriental and occidental civilization.

According to Prof. Takayanagi, Mr. Edmonds is most anxious to prepare the best possible plan, with the object of erecting an edifice in Tokyo of permanently well-appointed nature. The cost, it is said, will be borne largely by American patrons. Prof. Takayanagi told the *Tokyo Asahi Shimbun* that it was quite an inspiring sight to see over one thousand students of different nationalities mingle and pursue studies in the International House at Berkeley, where he lived during his last visit to the States. He met there about 30 Japanese students living in a very congenial atmosphere.

Railway Progress in Indo-China

New Outlet to the Sea—A Rear Entrance—Provided to China by Completion of New Line in the South

OPENING up a new and important era in the history of communications and of railway transportation in Indo-China and a development, incidentally, of immense importance to China, the potentialities of which have hardly been commented upon, was the completion after many years of strenuous effort, during which many numerous major technical and other obstacles were overcome, and the formal opening on October 1 of the trunk railway that crosses the entire length of French Indo-China from North to South.

Work on this important and strategic railway was started many years ago. With the formal opening of the tunnel at Cap et Corniche du Varella, approximately in the center of the line, the last link was forged and the entire line at last realized.

The opening of the tunnel and the simultaneous completion of the line marks another step in the history of railway exploitation in Indo-China, which dates back as far as 1885. In this year, the important port of Saigon was connected by a one meter gauge line to Mytho, 44 miles distant, which was later to form a link in the main trunk line just completed. In 1894 another similar link, a 65 mile narrow-gauge line was opened to traffic between Phu Laung Thuong and Leng Son in Tonkin, northern province bordering China. Since the country through which these early railroads ran was infested with bandits, the Government was compelled to erect a series of blockhouses manned by native garrisons under the command of French officers. All these strongholds still stand, but merely as a remembrance of difficult times past when trains were pillaged and railway officials held for ransom.

At the beginning of the century a general plan of construction of French railways in Indo-China was established. In 1902 the Tonkin line was ex-

tended so as to connect Dong Dang and Na Chan on the Chinese border with Hanoi, a distance of 112 miles. A wide gauge of one meter was adopted since the traffic on the Saigon line had shown great promise.

Early work on these lines was carried out under extremely difficult conditions. They passed through thick tropical jungle and thousands of workers died from malaria. Others fell victim to snake-bites and attacks by tigers or other wild animals. Every rail represents struggle and victory against Nature.

Whereas the line connecting Na Chan and Hanoi was constructed by the Government, a private company, the "Compagnie Francaise des Chemin de Fer de l'Indochine du Yunnan," soon entered the field and started work on the section from Haiphong to Lao Kay on the Yunnan border, 249 miles distant. This line was later extended into Yunnan as far as Yunnanfu, now known as Kunming.

In the years following, the main line of the railway system, called "Transindochinois," was pushed southwards from Hanoi and northwards from Saigon. The Great War interfered with this enterprise; but following the return to normal conditions, activities were resumed. The uncompleted gaps steadily decreased in size until with the opening of the Cap Varella tunnel, Hanoi and Saigon, 1,090 miles apart, were at last connected by rail.

The Chinese point of view toward the Yunnanfu-Haiphong line in the past and even now is indeed a negative one. The Chinese complain that the rich resources of Yunnan are being drained by means of this railway to the disadvantage of China. This objection is indeed a superficial one. It is most apparent that without the railway, China would not be able to reap benefits from the resources of Yunnan. The fact that the products are



A Cantilever Bridge on the Trunk Line of the Indo-China Railway



Gorges of the Pa-Ta-Ho River on the Indo-China Railway



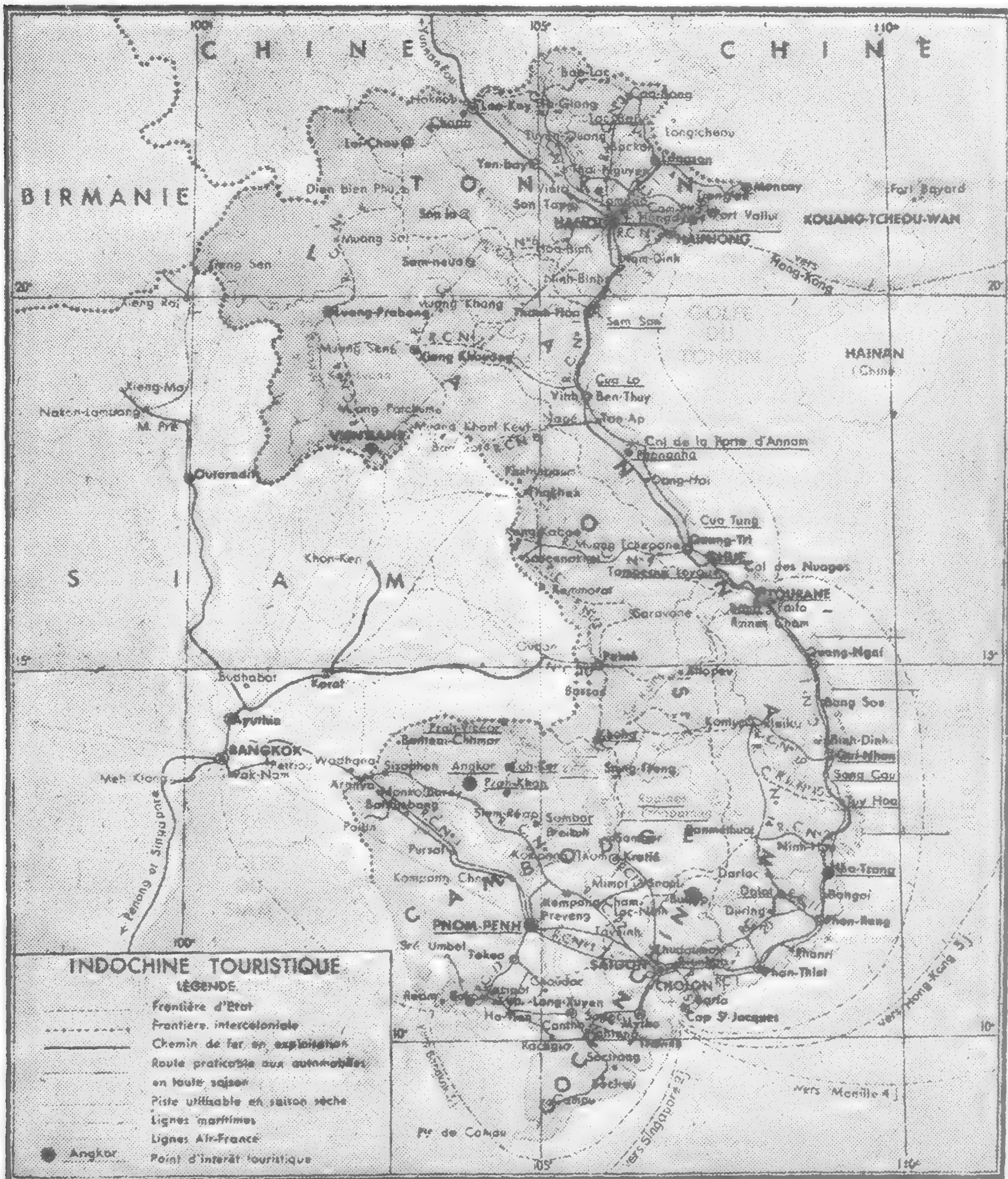
The Lace Bridge of Trunk Line of the Indo-China Railway

shipped through a non-Chinese port is of comparatively minor importance.

But what should be considered from the Chinese point of view, especially in these days of political chess-playing in the Far East, is the obvious fact that the Yunnanfu-Haiphong line is likely to become China's life-line. This supposition is not an idle one. To take a distinct probability: a Sino-Japanese war. In such

a case, China would face a Japanese blockade. This would mean that all of China's important ports, including Shanghai, would be cut off. "Nanking would have to be prepared to abandon Shanghai, Tientsin, and Canton, withdrawing into the interior to make its stand." Mr. Roy Howard, eminent American newspaperman, declared during his recent visit to the Far East.

(Continued on page 550)



This map shows the immense extent of territory south of China now linked together through completion of the new rail line from Hanoi to Saigon, enabling the traveller to board a train at Yunnanfu and travel by rail as far south as Mytho, south of Saigon

Singapore-Sydney Flying-boat Survey

By HUDSON FYSH in "The Aeroplane"

Between May 7 and May 25 a Singapore flying-boat of the Royal Air Force, in which travelled Major H. G. Brackley, D.S.O., D.S.C., F.R.G.S., R.A.F.O., Air Superintendent of Imperial Airways Ltd., and Mr. Hudson Fysh, Managing Director of Qantas Empire Airways, flew from Singapore to Sydney to survey the proposed route along which the fleet of Short flying-boats, one of which is seen above, is to assure Imperial air communications with Australia. Mr. Hudson Fysh, Author of this article, founded Queensland and Northern Territories Air Services Ltd., in 1922. It soon became known among Air Transport people all over the World as "Qantas." At first it linked up the railheads at Charleville, Camooweal and Cloncurry, but it ended by running straight through from Brisbane to Port Darwin, along what is to-day our Imperial air mail route. Therefore a description of the survey of the future Imperial air route by such a famous and successful pioneer as Mr. Hudson Fysh has a particular interest.

THE R.A.F. Flying-boat Survey from Singapore to Sydney was of particular interest to me, as, like many others, my knowledge of flying-boat operation did not equal that of the more familiar land going aircraft. To be sure, I had experienced the delight of a trip on a Short Scipio across the Mediterranean with Imperial Airways—a flight which left a

most favorable impression because of the great sense of comfort, security, and stability, but this was something different—a journey of many days' duration which would enable one to become really familiar with the flying-boat and its capabilities, besides our job was to spy out new waters and, in fact, make the first survey, apart from purely military flights, of a route as yet in the rough. A route possibly destined in the future to carry the main arterial air traffic between England and the Antipodes. To accompany the survey was therefore something of a privilege and a pleasure. An experience it undoubtedly turned out to be.

The air journey from Singapore to Sydney, whether by land or sea, is one of the most interesting in the World and presents an ever-changing variety of interest. An attempt will be made to catch some of this interest and give an impression of the trip in a diary form.

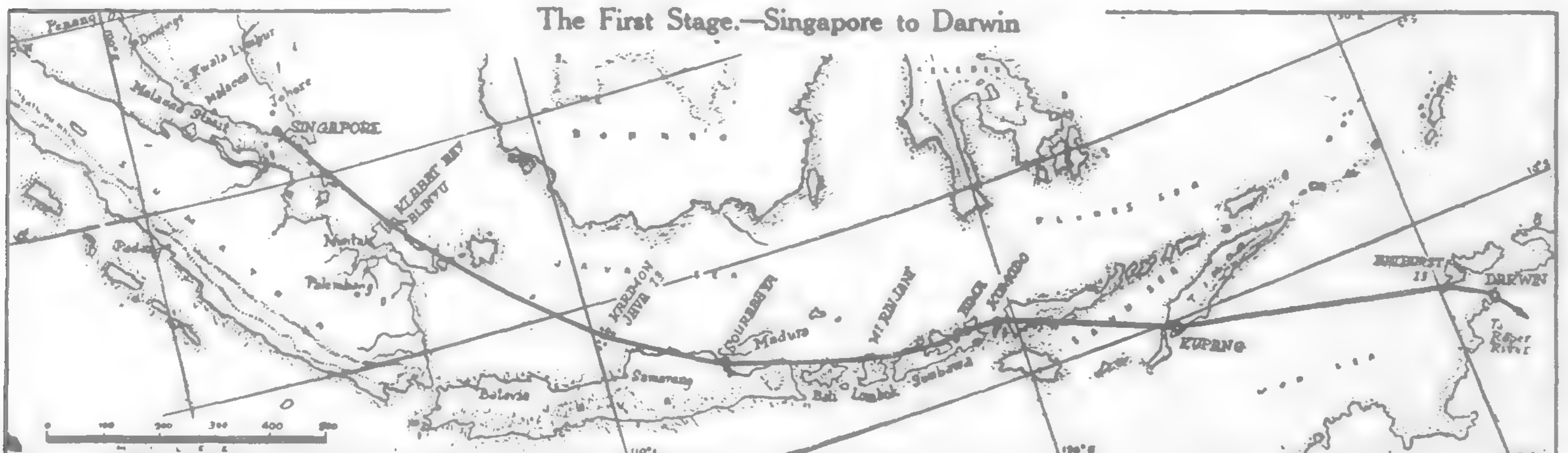
We Make a False Start

It is 8 a.m., and after saying good-bye to Air Commodore Sydney Smith and other officers, we are chugging our way over the water in a R.A.F. launch to where the big Short Singapore Flying-boat lies at her moorings. We climb aboard and soon



The Imperial Airways Flying-boat "Canopus," built by Short Brothers, Rochester and Bedford, Ltd.; four 910 h.p. Bristol Pegasus XC motors, variable pitch airscrews. This is one of thirty big flying-boats designed specially for the Imperial Air Routes to Australia and South Africa, and ultimately to New Zealand and America

The First Stage.—Singapore to Darwin





The ship that made the survey—A Short Singapore, four Rolls-Royce Kestrels, of No. 205 Flying-boat Squadron R.A.F. lent for this special service

are taxiing out across the bay warming up the four 600 h.p. Rolls Kestrels preparatory to the take off.

One saw at once—and it was to be realized more fully later on—that in flying-boat operation seamanship constantly comes into the picture. Boat work; mooring and casting off; anchorages; study of tides and the state of the water; study of the weather—the Englishman with his great seafaring tradition should be thoroughly at home in such conditions, and one sees a modern revival of the ancient call of the sea in the Empire Flying-boat Scheme which is now in the stages of preparation.

We are ten souls on board, Major H. G. Brackley, Air Superintendent of Imperial Airways being in charge of the Survey and Flight Lieut. Riccard (answering to the name of "Tex" or "Rick") in charge of the Boat and acting as pilot. There is really an eleventh member of the party in "George," the automatic pilot. He is a stout fellow and proved well worth his weight. He almost has a soul, and I am reminded that Homer in his *Odyssey* written some two thousand years ago predicted the automatic pilot in these words:—

"So shalt thou quickly reach the realm assigned,
In wondrous ships, self-moved, instinct with mind.
No helm secures their course, no pilot guides:
Like man intelligent they plow the tides."

Just as we were about to cross the equator the starboard forward Kestrel suddenly stopped, and it was necessary for us to proceed back to Singapore on three engines.

This seeming misfortune enabled me to witness some very smart work by 205 Squadron. We were back off the Air Station at 10.50 a.m., and in a very short time the boat had been got out of the water on to the slipway, pulled into its hangar, and the work of changing the engine commenced. By 5.30 p.m. the engine had been changed and the boat was back on the water with the new engine successfully run up—all O.K. for another start to-morrow.

Singapore—Klabat Bay: Tropical Isles, and a Night on a Flying-boat

At 9.30 a.m. we got off the water and with the Kestrels roaring happily headed for Klabat Bay on Banka Island.

We are passing island after island—the whole sea seems dotted with them, and as our altitude is quite low it is amusing to watch for signs of habitation and life. On some of the larger islands, which are thickly jungle covered, can be seen rubber plantations won from the heavy vegetation, and there is the ever-present coconut palm growing in its pretty natural surroundings. Native dwellings raised on high stilts keep looming into view on some inlet or creek, and sometimes a Malay is seen pushing off in a canoe or out at sea fishing.

Many of the smaller islands, with their white palm-fringed beaches bordering on the sparkling sea, appear as the dream tropical islands of the

adventure stories of our youth—air travel has made these things living and real for the first time.

Klabat Bay proved to be a fine stretch of sheltered water and soon we were at the anchorage and the little auxiliary motor doing good work sucking petrol up into the tanks of the Singapore.

The "Shell" Agent and Harbor Master kindly took several of us off in a motor launch powered with an old Ford motor, and shortly we stepped ashore on a sandy beach where coconut palms grew thickly around.

The chief memories of Belinyu, a small native village and tin mining center, situated a few kilometers from the beach, where we went to pay a courtesy call on the Dutch Controller, are of our Chinese Shell Agent guide, who spoke a little English and seemed to be quite the magnate of the place, as he appeared to own most local enterprises, even to the Picture Show, and of the Controller and his wife,

who very kindly entertained us to dinner. Dinner was served well after 10 p.m., and it was well into the wee small hours before we arrived back at the Singapore ready for bed.

Bunks were all made up complete with sheets and blankets, and, after turning out the electric light, we were soon lulled to sleep by the lapping of the tide against the hull. Outside the reflection of our mooring lights flickered across the water. A night aboard a flying boat in the tropics is still a strange enough experience to appeal as romantic.

Klabat Bay—Sourabaya: Life on Board a Flying-boat

At 6.55 a.m. we take off from Klabat Bay on the 620 mile flight to Sourabaya.

The Singapore III is certainly a wonderful weight-lifter and the sturdy British build enables the carriage of big loads in safety. Take-off times under normal full-load conditions were about 30 seconds.

About an hour out we were served with an excellent breakfast. The menu read: Iced orange juice, fried eggs and bacon, bread and butter and marmalade. The excellent repast was washed down with a pint of coffee contained in a real man-sized china R.A.F. mug.

This is the longest stage on the trip without landing, and as we stood well out to sea after clearing Banka Island there was little to occupy our attention for some hours, so we wrote up notes and read. The steady roar of the engines from this military craft effectively drown all efforts at conversation, and intelligence



The starting Point, the Water Front at Singapore



The Club House and Slipway of the Royal Singapore Flying Club, the only Royal Flying Club in the British Empire

from one member of the crew to another is carried out by writing on a card.

It is interesting to watch the crew at work. "George" has been given control and Riccard is merely sitting in his seat perusing some nautical volume or other. The Navigator, Sergeant Pilot Elder, has just put his charts aside and has opened a cabin window. He has dropped a round tin containing a smoke bomb. Down and down, and over and over it goes till it hits the sea and bursts into smoke. Elder has taken a successful shot for drift, and is now back in his seat making adjustments to the course.

Corporal Fairweather is at the engineer's duty seat in the next compartment, and he scans at regular intervals an imposing set of engine instruments. This is the midway stage of the evolution of the engine room of the air which will come in the larger planes of the future. On the other side of the compartment sits Aircraftman Warren, the wireless operator. A typical operator he is and all enthusiasm in trying to contact some station or other half the way round the world. By the way, we have a Flying Officer Thunder and a Corporal Fairweather on board, and so cannot make up our minds whether the omens for the trip are good or not.

In the next compartment going aft and reached through a central doorway are four comfortable ship's bunks, and two of the off-duty crew are taking their ease, one obviously asleep and the other reading a racy-looking paper-backed novel. Overhead are hung mascots of various descriptions, trophies of the chase!

The next and aftermost compartment contains the kitchen and supplies—it is even possible to bake a cake or roast aboard when necessary. Further towards the tail down the long fuselage can be seen spare parts of various descriptions, and the walk to the gunner's cockpit, perched eerily behind the rudders and tail.

Looking back inside the hull one viewed the whole interior of the boat and was impressed with its sturdy metal construction and the completeness of its internal organization.

We are passing the Karimunjawa islands now and peering down at their reef-encircled shores.

Sourabaya in sight at last as we emerge from a heavy tropical shower and fly down the straits between the island of Madura and the mainland of Java. We are only a few hundred feet up here as the regulations prohibit approach to the anchorage at a height above 300 feet, and soon we bank into wind and breast the water inside the Naval Air Base enclosure. A "spot" in the hospitable officers' mess and we are driven into Sourabaya, where we are to wait two days before resuming the journey.

Memories of Sourabaya included the well built Dutch houses, each with its decorative lampshade in front, each vieing with the other for beauty and effect—it is quite a city of lampshades; the striking Javanese carved wood panelling in the British Consul's dining room, dinner in the open under the huge trees of the Simpang Club; and a visit to Selecta in the hills behind Sourabaya where we swam in the clear spring waters of a luxury pool 3,000 feet up amongst the scent of roses, and with coffee and other plantations on the hill sides.

Sourabaya—Koepong: Flying Down the Indies

It is 6 a.m. and we are glad to be in the air on our 420 mile run to Bima on Sumbawa Island. Sourabaya had proved hot and torrid.

The take-off in a large flying boat is rather interesting as it is so different from that of a landgoing aeroplane. The engines are started, and the anchor hauled up or moorings slipped at the same moment, after which the boat glides away over the water. Warming up the engines is done when taxiing out, or circling if the boat is already at its starting off place. You can't hold a flying boat with chocks or wheel brakes!

After the Engineer in Charge has given his O.K. and the boat is in position the engines are opened up, and a big bow-wave is pushed up

which curls on either side of the bow in miniature walls of water. Some of this is thrown up and over the bottom planes. Almost at once this wave disappears, and the front of the boat rises more every moment, sliding over the water instead of pushing it aside. The broad white wake narrows down till it is spurting off at the speed of pistol shots. The boat is soon on the step about half way down the bottom of the hull. The ripples of the bay overcome the natural reluctance to finally "unstuck" and she is air-borne.

As we leave behind us the vivid green plains and volcanic peaks of Java one is reminded that the first British ship to sail these waters was the historic *Golden Hind* which called at Java during Sir Francis Drake's daring voyage round the World some 60 years after Magellan performed a similar feat in 1519-1522.

We are now passing Bali the wonder Isle, and I have just had a message slip passed back to me.

"This is where some super high power, double acting binoculars would be a good thing. We could then spy out the countryside!"

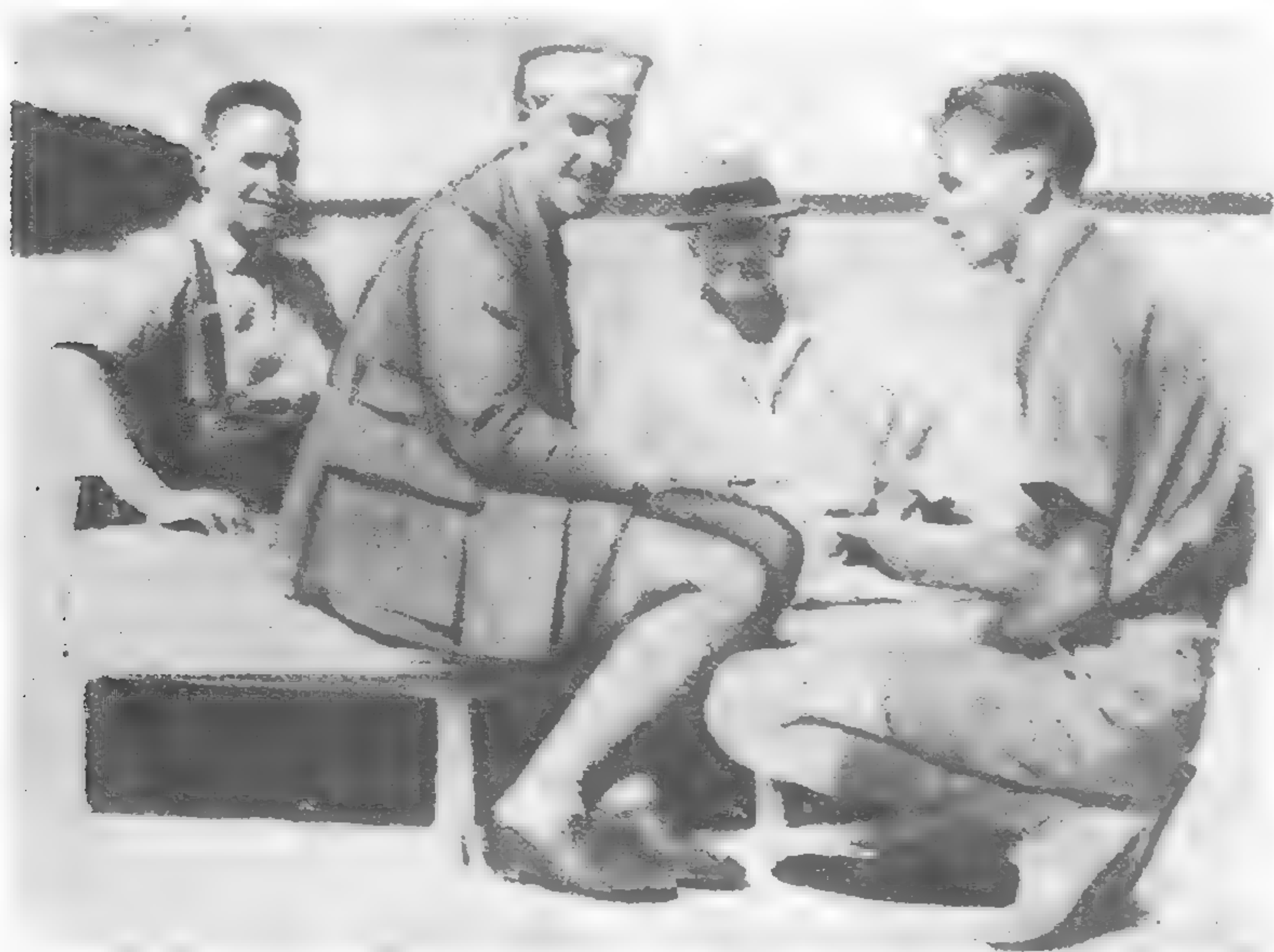
Bali has a charm all of its own, either from the air or the ground. As we slide past in close proximity to the 10,000 feet of Bali Peak's conical lava-scarred sides one marvels at the way this mountain is cultivated in little terraces and patches for 6,000 to 7,000 feet up its sides. Some of the cultivated areas on the steep slope must be much nearer the vertical than the horizontal, and so present an interesting problem of agriculture, and one thinks there is certainly no danger of a Ford Tractor or Sunshine Harvester being used on that precipitous slope.

Bali from the air conveys this impression—Crater-capped mountain tops wreathed in cloud—Purple and yellow hillsides—Prolific foothills and nestling towns and villages—Blue surrounding waters dotted with white fishing sails.

Lombok, another interesting island, is soon passed. Rinjini, 12,109 feet high, the highest peak in the Netherlands Indies, rears



End of the first stage of the Survey Flight—Port Darwin, which was once the back door to Australia



Some of the crew on the Survey Flight : Sq. Ldr. Hempel, Flt. Lt. Riccard, Sgt. Pilot Elder and Mr. McComb, Controller of Ground Services, Department of Civil Aviation in Australia



Major Brackley ashore at Koepang studying local color. The size of the horses explains the comment made herein on the Komodo Dragons

itself from the sea, but we did not pass high enough to see the beautiful lake with its lip of steam which is situated more than half way up the mountain.

We are soon at Bima after a flight of four hours against head winds. Sumbawa Island with its many curious volcanic formations had been interesting—some time in the dim long ago these islands must have been a veritable Devil's inferno of molten rock and mud spouting to the skies and spreading death and destruction. At present the giant lies sleeping as there is periodical subdued activity. There are many dormant volcanoes, particularly in Java.

Bima proved to be situated on a perfect sheltered bay, and is a Dutch outpost of island administration. We spent an interesting hour seeing the town and watching the rice harvest being gathered by the native population, man, woman and child in their age-long primitive fashion, each head being picked by hand.

The Komodo Dragon

Soon after leaving Bima on the flight to Koepang we passed the interesting island of Komodo—the home of the Komodo dragon—this is what *The Eastern Archipelago Pilot* has to say about it :—

"The island is mountainous and almost entirely covered with jungle. The island is practically uninhabited, the only village being Komodo on the East coast, and the few inhabitants live by fishing and hunting deer.

"A peculiar creature, sometimes called the Komodo dragon owing to its resemblance to that legendary monster, is found in the forests of Komodo and also on the neighboring island of Rinja : these beasts possess colossal strength, average about 15 feet in length, and attack the numerous wild horses on the island, and sometimes even man."

At 3 p.m. we arrive over Koepang on the island of Timor and are soon at our moorings off the jetty. Framed by a large square cabin window now latched open we see the town with its whitewashed walls come down to the water's edge, and its quaint old-world houses, which reminded those who knew their Europe of a "bit of old Portugal." These houses are no doubt remnants of the early

occupation, the Portuguese having first settled in Koepang about the year 1520, but in 1613 the town was taken by the Dutch who built a fortress.

We stayed a day in the town living at the comfortable rest house while Major Brackley investigated future flying-boat bases. In the evening we had the good fortune to witness the yearly Passer Malam or night fair, the most interesting part of which consisted of music and dancing by Timorese natives.

We were seated under a tropical moon with the beat of tom-toms and drums already throbbing in our ears, waiting for the performance to begin.

The Dance of the Meos

The first item on the program was the "dance of the Meos," the Meos being an order of professional fighting men employed in days gone by by the various Rajas of the Island. This particular group of Meos inspired respect as they advanced to the dancing arena with drawn swords and the medallions in their high head-dresses flashing. The dancing consisted of much mimic fighting, fierce gesture and stamping of feet, time being kept by attendants beating monotonously in three bars over and over again, while the bells attached to their ankles tinkled or crashed in unison according to the vigor of the movement.

Another dance of interest was that performed by the Savunese, the rhythm in this instance being supplied by small baskets woven from palm leaves which are attached to the ankles of the performers after being half filled with small beans. Every movement of the feet caused the beans to move inside the baskets, producing a different gradient of sound according to the movement made. Perfect time was kept and the effect produced was most pleasing to the ear, while the eye was delighted with the beautifully woven garments of the women dancers, set off by heavy gold and silver ornaments.

One of the most interesting among many native musical instruments was the "sesandow," which is a stringed instrument. The bamboo framework and palm leaf woven sound box of this instrument look exactly like a basket, for which purpose it is actually used when not in use as a musical instrument, and after the metal strings have been taken out.



By way of contrast, here is the Dornier No. 18 flying-boat "Aeolus," two Junkers Juno Diesel Motors



The survey party on the shore of Karumba Bay, the Singapore III in the background

Undoubtedly Koepang gives the impression of something new and out of the usual run, and anyone whose visit happens to coincide with the holding of the Passer Malam is assured of an interesting and unique experience.

Koepang—Darwin: We Cross the Timor Sea

As we taxi out for the take-off to Darwin a school of porpoises is playing right ahead. At such close quarters they look extraordinarily graceful as they cleave the water with their finest of streamline forms—it is a wonder we do not run some of them down.

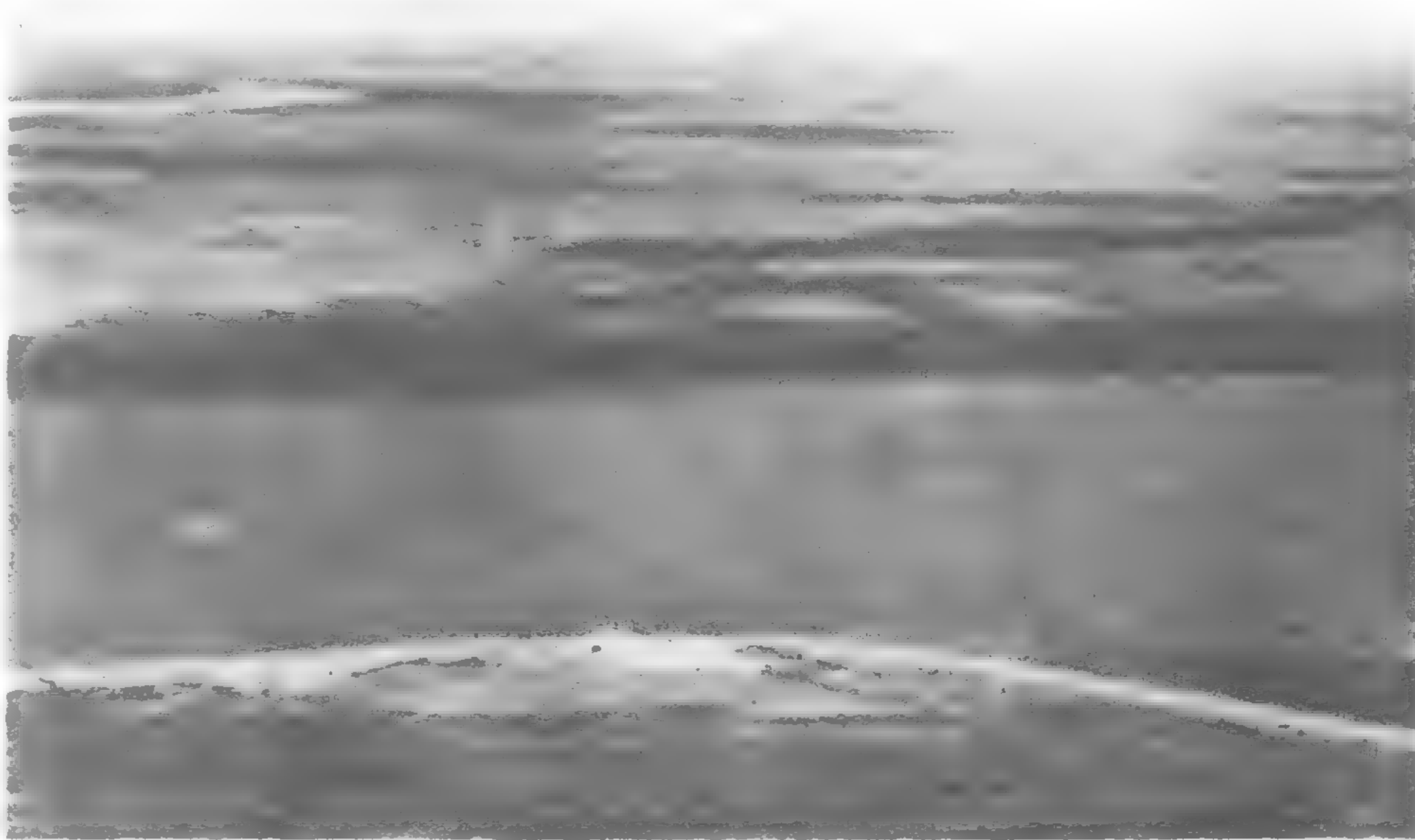
At 7.33 a.m. Koepang time we have dodged the porpoises and are off the water.

Nothing out of the ordinary seems to happen on these long flights over the sea, and certainly there is no thrill of danger in a four-engined aircraft with a good stout boat hull to boot—the even beat of the engines blends with the medley of noises produced by our rather lumbering passage through the air to form an all-enveloping crescendo of sound.

We are flying low against a stiff head wind. I suggest a sweepstake on the time of crossing. To my shame I won it banking on a dropping wind—the 526 mile crossing occupied five hours 47 minutes, including a detour taken to drop a note of greeting on the Bathurst Island Mission Station.

Bathurst Island is sighted right on our course, and one imagined with what feelings of joy and relief a similar sight of bonny Australia must have proved to the early pioneers, the Smith Brothers, Parer and MacIntosh, Hinkler and Cobham. Many crossings in single-engined aircraft have taken from eight to nine hours against the strong south-easterly winds met with right through the winter months. Now the four-engined aircraft of Qantas Empire Airways cross in under four hours' flying at 10,000 feet and over to avoid these strong winds.

Here we are at Darwin, that strange new front door to Australia which so often baffles the uninitiated visitor to our country: because it is so different from what he thought it would be. The truth is that Darwin has for so long been the isolated and neglected back door to Australia that it is but slowly getting used to a reversal of the order. Darwin must, however, fast come into its own: but at present, with its large Asiatic and mixed population it can hardly be said to be typical of Australia or of its "outback."



Part of the Norman River, of which a portion near Karumba would make an ideal anchorage

At the Victoria Hotel we attended a dinner given by the Civil Aviation Department's representative, the invitation to which had been wirelessly to us while crossing the Timor Sea. The Victoria Hotel is famous for its Aviators' Room, scribbled on the walls of which are the signatures of many pioneers.

Darwin possesses a very fine harbor, and on a steep cliff overlooking this is the "Darwin Cottage" where Qantas Empire Airways' passengers and crews are comfortably housed—for a day and a half we enjoyed the home cooking of the Housekeeper, Mrs. Ray.

We were joined here by Mr. A. R. McComb, Controller of Ground Services, Civil Aviation Department, and Squadron Leader A. G. Hempel, R.A.A.F., both accompanying the flying-boat through to Sydney and making our full complement twelve persons.

Darwin—Mornington Island: In "Outback" Australia

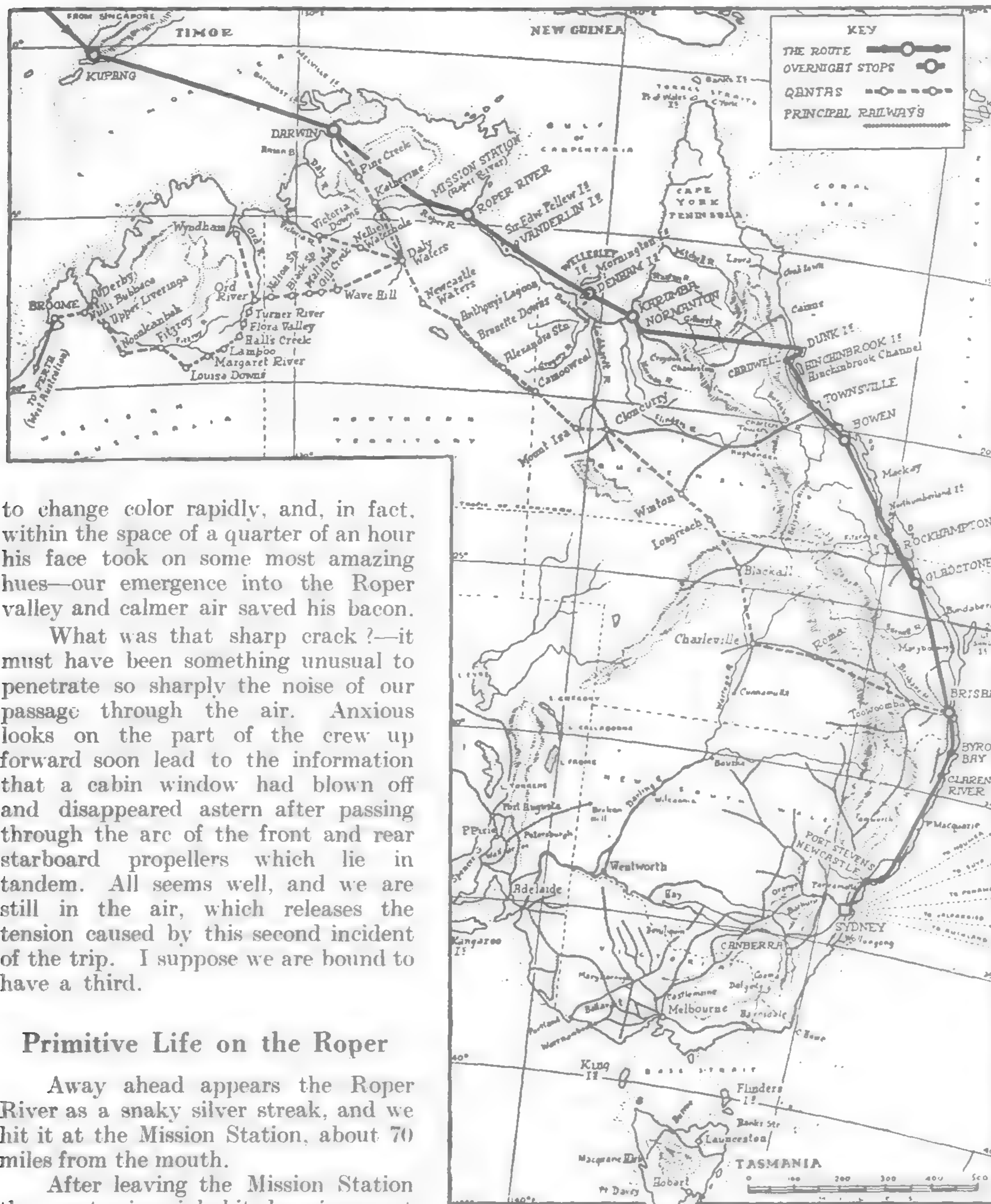
At 6.45 a.m. we take off from the harbor, bound for Mornington Island in the Gulf of Carpentaria. The Roper River is to be our first call however, and involves a hop of 300 miles across Arnheim Land.

In the future when regular night flying is a feature on the England—Australia Route the passenger who goes to bed in Malaya or Java, and waking up on this stretch, looks through his window, will immediately realize that a complete change of terrain has taken place—gone are the mountains and the sea, and there is no teeming population. No human sign of habitation meets the eye and the flat country side is clothed with straggling trees. The only remaining touches of the tropical East are the clumps of pandanus palms, and bamboos growing along the creek beds.

For the first 100 miles we see much game. Water buffalo—bred wild for 100 years and nowadays shot for their hides—gallop madly away. Kangaroo and wallaby speed across the grassy patches. Duck and geese rise in clouds from the lagoons and waterholes. The only signs of human occupation are the cattle and horses.

Soon we are flying low over rough country—a succession of rocky ravines and boulder-scattered hillsides—but no really high country.

It has got very bumpy, and one of our number, "no names no pack drill," who had dined well the previous night, began



to change color rapidly, and, in fact, within the space of a quarter of an hour his face took on some most amazing hues—our emergence into the Roper valley and calmer air saved his bacon.

What was that sharp crack?—it must have been something unusual to penetrate so sharply the noise of our passage through the air. Anxious looks on the part of the crew up forward soon lead to the information that a cabin window had blown off and disappeared astern after passing through the arc of the front and rear starboard propellers which lie in tandem. All seems well, and we are still in the air, which releases the tension caused by this second incident of the trip. I suppose we are bound to have a third.

Primitive Life on the Roper

Away ahead appears the Roper River as a snaky silver streak, and we hit it at the Mission Station, about 70 miles from the mouth.

After leaving the Mission Station the country is uninhabited again except for an odd black-fellow, and appears low-lying and generally uninviting: but as we near the mouth and circle for a landing well-grassed areas bordering two ideal broad reaches running almost at right angles are seen, and they supply a cheerful break in this desolate country.

We are taxiing on the muddy waters of the Roper, and after coming abreast of the site to be examined "whirr" goes the anchor chain (how does one describe that truly nautical noise of an anchor chain running out?—"whirr" seems ridiculous), and the anchor finally holds on the mud bottom five fathoms down, though we swing against the tide not far from the bank.

We are off the edge of a beautiful plain of waving grass land which appears over the five-foot banks, and a group of large turkey bustards leave off their feeding and gaze at our intrusion with much enquiry. Across the distant plain are a group of high anthills shaped like native huts, and further still is Culnare Bluff, the solitary protrusion from the plain.

Sly eyes and an inch or so of head appear here and there as if by magic—they are all round us—why the river must be just teeming with alligators.

Candidates for the trip ashore in the rubber boat begin to thin out—finally the frail boat is inflated, and with Thunder in the stern on guard with a big Service automatic we laboriously row ashore.

We step onto the hard mud and climb the banks—this place is truly most fascinating—untouched and far from habitation black or white. In fact a naturalist's paradise.

Swimming along near the banks we see dozens of queer little amphibians, which playfully seem equally at home on land or water. Presently, as we watch from the bank, along cruise a squadron of about 20 fish about the size of a large whiting. They have their heads above the muddy water and presently sighting the amphibians they clap on full speed. What a commotion, some of the little fellows are not quick enough, but the rest are up on the bank like lightning where they wait till the danger is past. What an illustration of the law of offence and protection. One wondered, if the amphibians finally get too smart for the fish, how many centuries must elapse before they too may become land-going and so enabled to chase their prey ashore. One noted that they had already found they could not see their prey in the muddy water. What magnificent interest—a month at this place would be fine.

Back on the flying-boat we find that a propeller has been changed. Several gashes had been cut in the leading edges of both propellers by the flying window, and we had come very near to having to prove how much more satisfactorily a flying-boat can be landed on land than a landplane on water.

Some of us left the interesting Roper with regret. As we gathered speed along the No. 2 reach the mangroves swept past us with increasing speed till finally the last spurt of white side wake vanished and we were "unstuck" and in the air headed for Mornington Island.

Along the Gulf to Mornington Island

The trip along the Gulf of Carpentaria is not of great interest. The shores are low and the immediate hinder country of such a poor quality that the only habitation consists of a few lone cattle stations.

We are passing the Sir Edward Pellew Group and look down on the bays and coves of Vanderlin Island. A fresh water lake is situated near the center of this island.

The Wellesley Islands are in sight and we alight off the Mission Station in the fine sheltered straits between Mornington and Denham Islands. The uncharted nature of this Gulf Country is realized when it is seen that the maps do not show Denham Island at all.

A stiff wind is blowing and as the Rev. Wilson says it will increase during the night Riccard wisely decides to change position and anchor under the lee of Denham Island. A wise choice as the wind howled during the night and our trusty boat dragged her anchor about 100 yards.

The Wilsons, wonderful people doing a great work amongst the natives and half-caste children, who are mostly sent to them from the mainland, made us very comfortable, and the youngsters gave us a great welcome in song.

Mornington is full of interest and deserves to be described in detail, but space will not allow. Incidents and memories of our next day's stay were the beautiful fish one caught and which fed twelve at dinner that night—the place is a fisherman's paradise. Then there was Jerry Jerome, the little black boy pet of the place, dark eyed and appealing, he had been reared to health and strength from a hopelessly sick baby. How those boys and girls could



Major Brackley on the beach of Stone Island, in the lee of which the Singapore took off from Bowen Harbor

After the strong winds of the last few days there was quite a bit of sea and as Riccard opened up for the take-off one felt that a new experience was coming. It was certainly over a 3-foot sea and with a jolt and a lurch a wave was cleaved to be diverted over the bottom planes and past our windows. She was "taking it green" for the first few seconds but soon was riding better and finally, fairly dripping water, she shook herself free into the air. Damage, a few tattered strips of fabric on wings and tailplane, and a slightly strained starboard wing tip float.

sing and their plaintive rendering of Old Virginia while grouped in the fading evening light was unique I feel sure outside of the old plantation days, and could those boys and girls eat! The island food resources, cleverly conserved by the missionaries, prove plentiful, and it was astonishing to see them clean up an evening meal of grilled salmon, and crab, a high-priced delicacy in the Australian cities.

Some hours after dark we witnessed a full-dress corroboree, the dim forms of the almost naked dancers being lit up by the flames and flying sparks from paper-bark torches. The weird chants and yells of age-long rites were with us still as, back in the Mission House, we fell off to sleep.

Mornington Island—Bowen—An Open Sea Take Off

After being rowed out to the boat by a pair of dusky Australian natives the first job was to up anchor. All hands and the cook were requisitioned, and this up anchor business is remembered as the only useful assistance one gave throughout the entire trip.

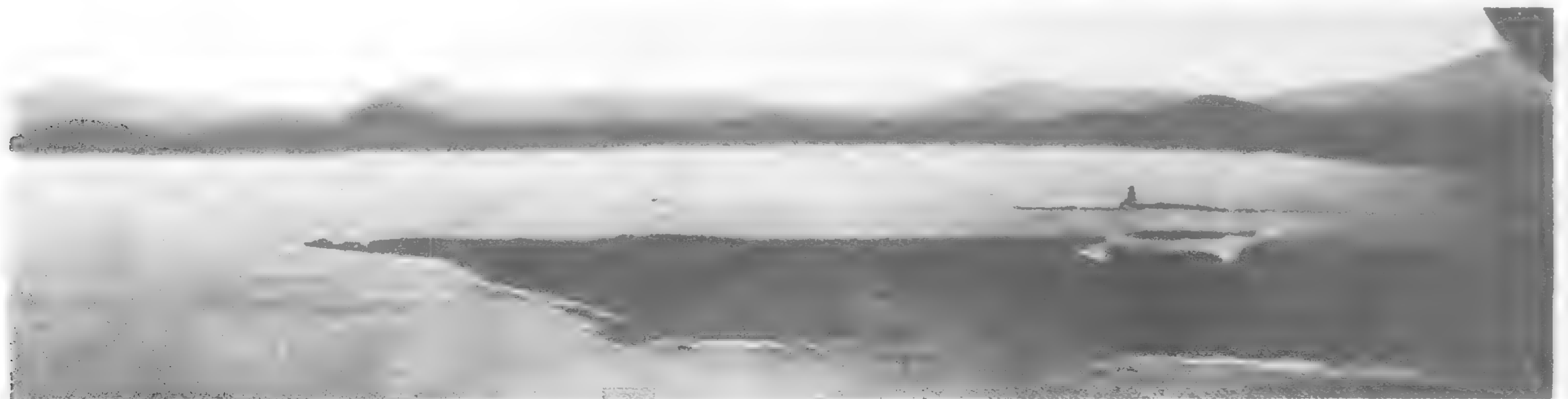
The take off for Karumba at the mouth of the Norman River provided our third thrill of the trip, if it could be called a thrill. The sandbanks and bars of the straits were uncharted and so it was decided to taxi out to the open sea for a take off. Getting over the bar was a ticklish business and more than once we felt the Singapore drag and lurch as she touched the sand beneath, but a hurried examination of the bilges showed that no damage was done.

On the Norman River and a Meal Flying Blind

Soon we are down on the Norman River at an ideal anchorage with our tail swinging a few yards from a sandy beach. The Norman should make a fine flying-boat depot. When coming in to land over the Pilot Station, in the shallows near the river mouth, we witnessed a most amazing number of fish—fish that exceeded the wildest fisherman's dreams both in size and number, mostly we supposed giant rays and sharks, they fled to deeper parts clouding the water with stirred-up sand and mud in their wake. One wondered what sense warns a fish of an aeroplane's approach—is it sight, or a sense of hearing?

On our way again a splendid take-off is effected—at no place yet have we been hampered by lack of good water—and after flying over the small township of Normanton head for the East Coast of Queensland 330 miles away.

Towards the end of the journey the low ranges we are to cross are seen to be enveloped in cloud and there is undoubtedly a spot of bad weather ahead. About the same time that lunch was announced we commenced to fly blind. With the boat completely enveloped in the surrounding mists we sat at the officers' mess table and ate our meal. This impressed so much with its novelty that the following note was made. "Ate a meal flying completely blind with flying-boat under the control of automatic pilot. Only discomfort 'bumps' and a few water leaks from the roof. Menu consisted of sausage, tinned salmon, tinned beetroot, cheese, Mornington Island bread, and coffee."



Bowen Harbor where the Singapore alighted after flying over some of Queensland's richest sugar cane plantations

Later we clear the worst of the weather and between rain storms emerge over Dunc Island, one of the many beautiful Barrier Reef playgrounds.

We are headed South at last and fly low along the much lauded Hinchinbrook Channel. Hinchinbrook Island at once threw one's thoughts back to Java. The steep slopes are a mass of tangled vegetation and impenetrable jungle, and from a small high plateau the waters of the storm leap and cascade to the sea below—a striking sight marred by the rain which again set in and drew a veil over the scene.

The trip from Cardwell down the coast to Bowen, which we reached late that evening, was flown over a picturesque countryside, and we passed the busy town of Townsville. Some of Queensland's richest sugar cane areas lay below—what a contrast this presented after the 1,200 miles of uninviting country we had flown over from Darwin.

We land in Bowen Harbor after 6½ hours in the air and the white tops of the wind-lashed waves hurried along by a fresh south-easter slap our hull.

Morning Under Difficulties

It is wonderful how this big boat with its great surfaces can be manoeuvred against wind and tide, and unerringly brought to her moorings. We approach the three buoys with a crew at mooring stations. The after hatch has been opened and from each side leans a mechanic each holding a rope to which is attached a drogue which is submerged astern. The drogue is a sort of sea anchor and besides slowing the forward movement of the boat can be employed in assisting to turn by using the drogue on one side only.

Out in the far nose another hatchway is open and from it leans the rigger clutching a species of boat-hook through the end of which is fastened a mooring rope.

The elusive buoy bobs nearer and nearer. A little manoeuvring of the engines. The rigger leans out farther, and snap! his shot has been a good one and we are fast. The engines die as switches are cut. The actual mooring line is attached, and the job is complete.

Transferring from the flying-boat to a motor launch per medium of a small dinghy was not without its interesting moments and the rubber fenders hung outside the exit doorway came into full use. Bowen showed what a seaman's game flying-boat is, and what can be done in rough weather.

It is still blowing half a gale from the south-east as we cast off and taxi over Bowen's fine harbor to the lee of Stone Island for the take off.

We are bound for Gladstone, and bucking a strong head wind fly south along a pretty coastline plentifully supplied with natural inlets and sheltered waters. We pass over Rockhampton, which possesses a good natural seaplane anchorage, and soon land at Gladstone.

Yesterday afternoon a thorough examination was made of Gladstone's excellent harbor. Now we are off to Brisbane.

The trip has been uneventful except for great activity during



A view of the Flying-boat "Canopus" in flight

the past hour when there has been much shaving, discarding of shorts, and general cleaning up in preparation for the arrival in Brisbane, our first city port of call.

One finds it difficult to write anything interesting about Brisbane, one knows it too well. All that can be said is that it was here various members of the crew started to succumb to the charm of our Australian girls—a demoralization which was to be completed in Sydney.

Another False Start

We take off at 8.35 a.m. for Sydney. Bad weather has been reported ahead, and as we fly along the coast the howling South-easterly gale, which had interfered with the normal inter-city air services tended to thicken. The surf below was magnificent as it foamed in forming a quarter-mile strip of white between the beach and the deeper water. Our ground speed (or should I say water speed?) was reduced to 67 knots by the time Byron Bay was reached, and it was decided to return to Brisbane.

Brisbane—Sydney—the Final Stage

Off again on our final stage, and a slightly better day. The frequent showers and low visibility are effectively spoiling the trip from a sight-seeing point of view. On a good day the Brisbane—Sydney journey cannot be surpassed for its beauty. We fly over the undulating farm lands of New England which spread themselves below and then fly along a succession of the most beautiful beaches in the World.



Flt. Lt. C. S. Riccard, now Sq. Ldr., and Sgt. Plt. Elder

The Clarence River is passed. Port Stevens. Then Newcastle, with the final culmination of Sydney with its lovely beaches and magnificent harbor capped by the Harbor bridge.

In Sydney and Journey's End

One of the most illuminating Australian expressions is "Sydney or the bush." It is commonly used when taking a racing or other big plunge the outcome of which is doubtful, Sydney being the epitome of all that is good and desirable, while to be consigned to the bush means that one is "busted" and has to get back to nature and the struggle for life.

Well, here we are in Sydney and it is all the sweeter for "the bush" having been slightly near at times. Few visitors are ever disappointed with Sydney because of its gay outlook and versatility, and no more fitting terminal for a future World flying-boat Service



Another view of the Flying-boat "Canopus" seen in flight from below

could be found than in its glorious harbor.

Since these notes have been written the Short Singapore III with Major Brackley and its R.A.F. crew has returned to Singapore after completing a tour of 9,400 miles.

That such a pioneering trip could be completed with full satisfaction over more or less uncharted waters from a flying-boat sense, and considering the big overload (there were 13 persons on board from Brisbane to Darwin on the return trip) speaks volumes for Flight Lieut. Riccard and his crew, and also for the trusty "boat" which carried them. It also speaks well for the satisfactory nature of the route.

It is hardly within the scope of these notes to discuss the merits or de-merits of a flying-boat Service from Singapore to Sydney, but this much can be said with confidence—if there is anything in the future of flying-boat operation then the Singapore—Sydney Route holds some distinct advantages. Apart from Empire Airways considerations, the general conditions tend towards the ideal and are such that provide real flying-boat safety. From Singapore to Koepang one never even sees surf, the frequent waters are so sheltered and the Timor is usually tranquility itself. The Gulf of Carpentaria is sheltered and most of the trip down the Queensland coast is inside the Great Barrier Reef. Sheltered inlets and rivers are frequent, and the two land crossings do not hold any terrors for four-engined Civil Flying-boats—any aviator given his choice would rather land a flying-boat on land than a landplane on water.

Many thanks to Major Brackley, Flight Lieut. Riccard and crew for a very interesting and informative trip—the big pint china mug with blue R.A.F. crest which stands in my cupboard will remind me of it for many a long day.



Ashore at Roper River; Major Brackley and Mr. McCornbe in the rubber dinghy, which seems far from alligator-proof

JAPANESE OIL DEVELOPMENTS

Important developments occurred in rapid sequence in the Far East oil industry recently, and an announcement from Tokyo states that under sponsorship of the Japanese Government, including the departments of the Army, Navy, Foreign Affairs and Colonies, a drive has been undertaken to exploit crude oil production in Pacific areas outside of Japan. Three of Japan's leading oil concerns—Mitsui Company, Mitsubishi Shoji Kaisha and the Sumitomo Company—have formed a combine to operate under the new fuel policy of the Government. It is capitalized at Y.50,000,000, or about £3,000,000, and preliminary expenses of Y.1,000,000 have been authorized.

According to information confirmed by Japanese interests two companies have been producing an average of 13,640 barrels per day during the past year under concessions in Borneo. The first definite step toward forming the combine calls for consolidation of the Mitsui Trading Company and the Borneo Oil Company, which would be Japanese controlled. The former is a marketing concern, and the latter has oilfield experience, which will be of value in searching for new sources of supply.

Local advices are that the combine results from a virtual Government order to spend money in the search for crude oil and

to act in concert. This step is looked upon as a logical development of Japan's policy established in 1934 by adoption of an oil law giving the Government complete control. It is part of the basic policy of the Government to make Japan as self-sufficient as possible in all products required for military operations, in event that war cut off outside sources of supply.

According to private dispatches to Japanese exporters here, the Milham interests in control of the Seaboard Oil Company have contracted to supply the Ogura Oil Company of Japan with 100,000 tons of Kettleman crude, to be delivered over a period of several months. This oil will come from Milham production at Kettleman, part of which is sold under contract to the Texas Company.

It was to provide an outlet for the remainder of the Milham production that the Texaco-Seaboard pipeline is being built. Before the completion of this line, Seaboard supplied its first cargo on the Ogura contract by buying back some of its own oil sold to Associated Oil Company. This oil sold to Associated at the field, was bought back at Avon on the northern reaches of San Francisco Bay and loaded on the M.T. *Tatekawa Maru* at Amarcos, near Avon. Future deliveries will be from the new Texaco-Seaboard marine terminal at Estero Bay.

The Showa Steel Works at Anshan Has Notable Record of Progress

**Thriving Modern Industrial City was Barren
Waste Twenty Years Ago**

HERE is certainly no modern industrial town that has developed as rapidly as Anshan. A thriving town though it is to-day, Anshan some twenty years ago was but an uninhabited tract of land surrounded by mountains. Who could have foreseen that a great industrial town would be created on this barren, deserted soil.

The discovery of iron ore in the Anshan district dates back to August, 1909, a matter of chance as a party of geological experts sent round by the South Manchuria Railway Company to make a survey of the hot springs in the locality happened to find the inexhaustible deposits of iron ore at Anshan.

The exploitation of the ore, however, was not undertaken immediately. In May, 1917, the South Manchuria Railway Company started the erection of an iron plant there. May, 1918, saw the establishment of the old Anshan Iron Works as an S.M.R. subsidiary enterprise. It was in April, 1919, that the first furnace was put into operation. This heralded the creation of the industrial town Anshan.

Soon afterwards, the Great War broke out to shatter to their foundations the structures of world peace, trade and economy. The demand for iron and steel in all countries was almost limitless for the duration of the war. The war boom afforded a potential incentive to the development of the Anshan iron industry just commenced.

But the enterprise suffered a serious setback at the termination of the war. What came immediately after was worldwide economic depression of unprecedented intensity. The demand for iron abroad declined sharply, placing the Anshan iron industry in travail. The period of several years after the restoration of world peace was one of great difficulty for Anshan.

With the rapid development, however, of modern industries in Manchuria, Japan and other countries, coupled with the gradual recovery of the world from the effects of the Great War, the demand for iron began again. Accordingly, to Anshan came a restoration of its former lively business, by gradual stages. Since the Manchurian disturbance of 1931, the Anshan iron industry has developed at a surprisingly quick pace.

Works Absorbed

In April, 1933, namely, two years after the outbreak of the Manchurian hostilities, the present Anshan Steel Works capitalized at 100 million yen (82 million yen paid-up) was established there to cater to the growing demand for iron and steel in Manchuria and Japan. The creation of this gigantic corporation was also of importance from the standpoint of Japan-Manchoukuo co-defence. A couple of months later, the Anshan Iron Works was divorced from the South Manchuria Railway Company and absorbed in its entirety by the Anshan Steel Works.

Simultaneously, the production capacity of the industry was greatly enlarged. Thus, Anshan has become the largest supplier of iron and steel in Manchuria. The annual output of pig iron by the Anshan Steel Works is about 420,000 tons at present, but after the completion of an expansion program now in progress, which is expected by next year, the putput will be increased to 650,000 tons. In addition, the corporation at present manufactures 400,000 tons of steel and more than 350,000 tons of sheet bars, billets and other materials. The pig iron output in recent years was:

1926	..	..	165,054	1933	..	..	312,056
1927	..	..	203,445	1934	..	..	346,370
1930	..	..	288,433	1935	..	..	411,700



Scene at the Showa Steel Works at Anshan which takes so large a part in the industrial life of Manchuria

As may be inferred from the foregoing figures, the production of pig iron has been steadily on the increase, reflecting the rise in the demand for the metal. Likewise, the output of other iron manufactures by the Showa Steel Works is following an upward trend.

Around the Showa Steel Works, various industrial corporations have been created, their capitalizations ranging from 100,000 to 10,000,000 yen. In this manner, Anshan as the biggest iron producing town of Manchuria and is steadily developing. Among these corporations are:

- (1) The Sumitomo Steel Pipe Company capitalized at 10,000,000 yen (2,500,000 yen paid-up) for the manufacture of steel pipes.
- (2) The Manchurian Roll Manufacturing Company capitalized at 3,000,000 yen, fully paid-up, for the manufacture of forged iron and machinery.
- (3) The Anshan Steel Material Company capitalized at 5,000,000 yen (1,750,000 yen paid-up) for the manufacture of light rails and other kinds of steel material.
- (4) The Manchuria Steel Manufacturing Company capitalized at 5,000,000 yen (1,250,000 paid-up) for the manufacture of gas pipes.
- (5) The Manchuria Kubota Iron Works capitalized at 1,000,000 yen, fully paid-up, for manufacture of water pipes and accessories.
- (6) The Manchuria Galvanization Company capitalized at 200,000 yen (70,000 yen paid-up) for the manufacture of galvanized steel sheets and nails.
- (7) Iguchi Yoko & Company capitalized at 100,000 yen (25,000 yen paid-up) for manufacture of bolts and nuts.
- (8) The Kwantung District Onoda Cement Company capitalized at 5,000,000 yen (1,250,000 yen paid-up) for the manufacture of Portland cement.



Part of the vast plant of the Showa Steel Foundry at Anshan



A 500 ton blast furnace in operation at the Showa Steel Foundry at Anshan



Mount Tahushan from which comes the iron ore which is used in the Showa Steel Works



Part of the vast plant at the Anshan Steel Foundry. At right, a blower serving the 350 ton furnace seen on left

Important Role

Thus, Anshan is the producer of all conceivable sorts of iron and steel manufactures which are being marketed throughout Manchuria and exported to Japan, North and South China and the South Seas region. Naturally, the town is playing an important rôle in the export trade of Manchuria, which fact must not be overlooked. In particular iron and steel are metals absolutely necessary from the point of view of national defence.

Formerly, Japan had to depend entirely upon imported iron and steel for the subsistence of modern industries requiring these metals. This situation was deplorable, for in the case of an emergency, supplies of imported iron and steel might be cut off. It is easy to think, of what grave consequences a suspension of such supplies would produce.

That Japan and Manchoukuo nowadays are on a nearly self-sufficing basis so far as these important metals are concerned is due largely to the Anshan iron industry. From this angle, the importance of Anshan to national defence and national industries can hardly be exaggerated.

Situated in the southern part of Lioyanghsien, Fengtien Province, Anshan is 192 miles to the north of Dairen. It has a population of more than 40,000. An official census taken as at the end of June, this year, put the total number of Japanese nationals there at 17,396 comprising 1,328 households. When Manchus and Koreans are added, the total populace of the town is estimated at over 40,000. In proportion to the development of the town, its citizenry is increasing.

Considering the growing importance of the rôle which iron and steel are playing in modern industries, Anshan is on the high road to development with its inexhaustible deposits of Manchuria. Side by side with Fushun, Anshan will grow in importance as an industrial town as time progresses.

Coal Mining in Manchoukuo

THE rich mineral resources of Manchoukuo have received the close attention of engineers and industrialists for many years and various attempts have been made to develop the metalliferous deposits says the *Iron and Coal Trade Review*. The coal resources are particularly rich and form one of the principal foundations on which the industrialization of certain areas of Manchoukuo is being planned. Only the more accessible coal-fields are being developed, the more distant ones, as those in Jehol, towards inner Mongolia, being still untapped owing to the absence of railway or other transport facilities. According to the latest Japanese estimates, states E. Reichelt in *Glückauf*, the known coal resources of Manchoukuo total about 4,500,000,000 tons, made up of 1,225,000,000 tons in Fengtien, 1,255,000,000 tons in Jehol, 800,000,000 tons in Kirin and 1,200,000,000 tons in Heilungkiang.

The annual output of the Manchoukuoan collieries was about 10,000,000 tons in 1933, of which 80 per cent was produced by the Fushun collieries and six per cent by the Penhsihu. The Fushun collieries, which lie east of Mukden, are the property of the South Manchurian Railway, all mining concessions of which were transferred to the Japanese Government by the Treaty of Portsmouth in 1904-5. Under Russian control, the daily output of the Fushun collieries was only 300 tons, but rapid developments took place under Japanese ægis and production reached 5,000 tons per day in 1912 and 7,000 tons in 1918. At the present time the daily output is on an average 22,000 tons. The total production of these collieries was 223,000 tons in 1907 and advanced to 6,983,000 tons in 1927 and 7,032,000 tons in 1929. After a decline to 5,724,000 tons in 1932, a very large increase was achieved in 1933, when 8,000,000 tons were produced. About half the coal mined is consumed in Manchuria, 10 per cent is shipped as bunkers and 40 per cent exported. An analysis of the exports of the Fushun collieries is given in Table I. Other Manchoukuoan collieries do not export



The blower for a 500 ton furnace at the Anshan Steel Foundry

much coal, their total exports being estimated at around 500,000 tons per annum.

TABLE I.—COAL EXPORTS OF FUSHUN COLLIERIES
(In 1,000 metric tons)

Year	To Japan	To Korea and Formosa	To Philippines, etc.	To China	Total exports
1928	1,849	455	192	1,138	3,634
1929	1,887	415	223	1,268	3,794
1930	1,712	414	177	1,341	3,644
1931	1,816	370	171	1,371	3,729
1932	1,790	401	177	825	3,193

The financial results of the Fushun colliery have naturally been seriously affected by the political disturbances in recent years and the general economic insecurity. Thus, while in 1912-13 there was a surplus of Y.1,847,000 on a gross income of Y.9,194,000 which had advanced to Y.12,275,000 on an income of Y.84,365,000 in 1929-30, the disturbances in 1931 to 1933 resulted in a serious decline to a surplus of Y.128,000 and an income of Y.55,086,000 in 1932-33. The comparative tranquillity of the following financial year, 1933-34, however, resulted in a substantial recovery to a surplus of Y.5,077,000 on a gross income of Y.70,976,000. The results of the current financial year, 1934-35, are expected to show a further substantial improvement.

Tungsten in the Far East

Company in Philippines Closes Contract with Hongkong Government for the Exploitation of Wolfram Deposits

ALTHOUGH no deposits of tungsten ore have been discovered in the Philippine Islands, a Philippine corporation is about to start development of the mineral in China, says *The American Chamber of Commerce Journal*.

Announcement was made on May 12 that the Hongkong government had accepted the proposal of Marsman and Company to explore wolfram deposits in the New Territories. Engineers of the company have been to the location of these deposits, which is said to be not far from Kowloon, across the bay from Hongkong itself: J. H. Marsman, president; Major A. Beckerleg, head of the consultation staff of engineers; and B. S. Ohnick, director, of the company went to Hongkong early in May to complete the deal.

It was reported that if expectations are realized, mining operations will be started in four months. It is likely that the engineering talent for the development work will be supplied from the present staff of Marsman and Company, now scattered over the Islands from Suyoc to Mindanao. Philippine capital is invested in Marsman and Company; investors in the company will follow closely the progress of this venture into a new field.

Tungsten is a rare, heavy, greyish-white metal: its chemical symbol is W: its atomic weight is 184: its density is 19.1: its melting point is 3,380 degrees Centigrade, and its atomic number is 74. It was discovered in 1,783 by d'Elhujar.

Twenty-five years ago tungsten was an expensive, little-known, and little-used element. To-day it finds general use in the electric lamp filament and in radio tubes, but its major use is an alloy in high-speed tool steel and in several other special steels.

The amount of tungsten ore used in the world is comparatively small. In 1933 there were less than 7,000 tons of the ore produced, and around 11,000 in 1934.

Tungsten occurs in nature as the tungstate minerals: wolfram, scheelite, hubnerite, and ferberite: and in the altered form as an oxide variously termed tungstic oxide, tungstite or wolframine. Of these wolfram is commercially the most important.

About 70 years ago tungsten was first used for improving the quality of tool steel. It was first introduced into the steel in the form of the mineral, but from 1890 onwards tool steel containing substantial percentages of tungsten came into use and made it necessary for tungsten to be prepared in metallic form. For many years metallic tungsten powder was the form in which the metal was used by tool steel makers, who worked almost entirely in crucibles. Through the use of electric arc and high-frequency furnaces, tungsten metal powder has been replaced to a large extent by ferro tungsten, smelted directly from the ore by electricity or Alumino-Thermic methods. The consumption of tungsten has varied very much over 30 to 40 years, as it has followed closely activity or slumps in engineering.

Previous to the World War most of the production came from British territory, but the market was dominantly in Germany and the reduction products were supplied to Sheffield, where British consumption was centered, as powder or ferro-alloy, and there was little curiosity as to the sources and methods of production so long as supplies were available.

From 1900 to 1910 prices began to rise, with the increasing demand due in part probably to German stocking up in anticipation of possible war. In 1910 production was about 7,400 tons, falling to about 6,600 tons in the next year and averaging about 8,000 tons up to the outbreak of the War. Increased quantities began to reach the mineral dealers in England about 1911, and interest in that country for metallurgical applications are said to have started at about that time. There was much interest shown in the metal in Germany and in France, and the start of the War brought about considerable activity in the industry in England.

The demand for tungsten during the War led to a rapid increase in price and consequently in production. In 1915 the price in Great Britain was fixed by the ministry of munitions at 55s. a unit: this was raised in 1918 to 60s. with allowances. At this time the bulk of the supply was in British hands, and the rapidly growing

demand in the United States for the mineral led to a rise in price up to \$120 per unit.

Early in 1917 important discoveries of wolfram were made in China, and as the ore was very cheaply produced, Chinese output rose rapidly so that by 1918 the world output was estimated at about 22,000 tons of ore.

After the War there was an immense accumulation of concentrates and of powder and ferro tungsten, as well as of tool steel. When the price was decontrolled there was a great slump in the market which rapidly put most producers, with the exception of China, out of operation. From that time on, China has dominated the market.

Recovery in price was slow, when demand did not begin to revive. During the latter part of 1928 prices improved, and in 1929 the American Tariff Bill, and negotiations for the formation of the European cartel (for the control of the market) boosted the price considerably. In August, 1929, the top of the movement was reached, when a top price of 40s. was recorded. By this time the cartel had been established and the price fell at the end of the year to 34s. With the world-wide slump, the price fell in 1930 to 30s., and at the end of 1932 had declined to 10s. 6d.

In the spring of 1933 there were reports of agreements to control shipments from China, and in May and June prices began to firm up slightly, and when eventually the Nanking government intervened and established a monopoly of export the present cycle of high prices was well on its way to establishment. At the end of the year the price was around 28s., and last year (1934) prices advanced to around 50s. This high price stimulated production from producing countries outside China, resulting in a lower tendency, with prices standing at about 36s. in August, 1935.

As nearly as can be estimated, the arrivals of wolfram ores in Europe have been as follows: 1931, 11,228 tons (of which 5,642 tons was Chinese): 1932, 6,114 tons (of which 2,821 tons was Chinese): 1933, 8,614 tons (of which 4,287 tons was Chinese): 1934, 11,000 tons (of which 4,230 tons was Chinese).

The countries producing the bulk of the world's requirements are China, Burma, Malaya, Bolivia, United States, and Portugal, while Australia, Argentine, Cornwall and several other countries have contributed substantial quantities.

In 1932 the production of tungsten ores, expressed in metric tons of tungsten concentrates containing 60 per cent WO_3 (wolfram), as given in the *Engineering and Mining Journal* of New York in a chart prepared by the Bureau of F. & D. C. and the Bureau of Mines of the United States, was as follows: China, 22.5: India, 22.3: British Malaya, 5.5: Bolivia, 6.9: Europe, 3.2: United States, 3.6: Indo-China, 2.5. Apparent consumption, also expressed in metric tons of tungsten concentrates containing 60 per cent of WO_3 , was Europe, 59.8: United States, 4.6: Japan, 2.8. Thus China, India, British Malaya, and Indo-China exported all of their production, and used none of it, while Europe produced but a fraction of its needs.

Tungsten is one of the few minerals which the Far East contributes to the world's trade in any amount, antimony and tin being others. In 1924 China supplied 63 per cent of the world's tungsten: Burma, 18 per cent: Siam, 13 per cent. In 1927 China supplied 64.3 per cent of the tungsten used in the world.

China dominates the world tungsten market, in spite of high tariffs levied against the ore by the United States and other countries. Tungsten had no value to the ancients, so that the abundant ores found in the residual soil over the veins in which it occurs were not mined away. When there came a period of world shortage at the time of the War, attention was attracted to the Chinese deposits. A little was mined during the first year of the War, and production rose in two years to an estimated output of 10,000 tons of concentrate.

The Chinese tungsten ores occur at the surface, and are readily amenable to wet concentration with a simple plant. This fits

(Continued on page 550)

The Rangoon Tidal Model

RECENTLY printed in the columns of *The Engineer* was a statement issued by the Commissioners for the Port of Rangoon in May last referring to the reports made by the Commissioners' consulting engineers, Sir Alexander Gibb and Partners, following on the completion of the tidal model experiments begun under their direction in 1932. In this statement the Commissioners announced their decision, at which they had arrived after considering the engineers' report, not to embark upon a program of dredging on the Outer Bar, as indicated by the engineers, which would involve a considerable burden upon port funds, but to adopt a policy which in effect envisages the future development of the port to deal expeditiously with vessels drawing not more than 28-ft. of water.

By the courtesy of the Port Commissioners and of Sir Alexander Gibb and Partners, this publication gives as follows a description of the very interesting tidal model with which the exhaustive experiments were made, as well as a summary of the two principal reports made by the engineers.

Rangoon, the capital and chief port of Burma, is on the Rangoon River, 25 miles from the sea. It deals with over 90 per cent of the overseas trade of Burma: it is one of the largest passenger ports in the world: and it is the center of a great inland transport system involving about 1,000 miles of navigable waterways on the Irrawaddy River and its branches. The 2,000 miles of Burma railways are centered on Rangoon, and practically the whole of Burma, with its area of 230,000 square miles and population of 13,000,000, forms the hinterland to the port. By the overland trade route its influence extends into Western China. The exports for which Burma and Rangoon are noted are rice, timber, lead, zinc and oil, the annual value in normal times being about £25,000,000. Before the present depression the average ocean-going tonnage entering the port was 4,213,000 tons, and the seaborne trade 5,559,000 tons. The prosperity of Burma is thus dependent to an exceptional extent on the maintenance and prosperity of the Port of Rangoon.

The Rangoon River forms the most easterly outlet of the Irrawaddy, but has also an independent existence. The Pazundaung and Pegu rivers join the Rangoon River just below the city, and have contributed to the formation and growth of the Hastings Shoal, which has until recently been the dominant consideration in the navigation and conservancy problems affecting the port. Concurrently with this, however, there has been an apparent deterioration of the whole regime of the river, accompanied by continuous erosion of the banks, most noteworthy at Elephant Point, where the right bank has been eroded to a depth of $1\frac{1}{2}$ miles.

On both flanks of the river, at its embouchure into the Gulf of Martaban, there are extensive alluvial deposits which stretch for miles into the gulf in the form of a submerged declining plane. The crest of this plane constitutes what has come to be known as the Outer Bar of the Rangoon River. Latterly, the principal problem in the maintenance of access to the port has been this bar. As a result of the natural seaward growth of the Irrawaddy delta, the navigable channels over the bar have been gradually deteriorating

for some considerable time, but it was not until recent years that the bar began to exert a limiting influence on the draught of vessels. In 1884 there was a fairly stable channel of about 20-ft. minimum depth. By the end of 1931 there was a large shoal area about three miles in breadth carrying less than 12-ft. at L.W.O.S.T. Since the average rise above L.W.O.S.T. at this place is 21-ft. on spring tides and 16-ft. on neaps, and the largest vessels trading to Rangoon draw 30-ft. laden, the position was clearly unsatisfactory and the future uncertain.

The situation was carefully studied by the Commissioners' chief engineer and the consulting engineers: hydrographical and engineering surveys were made, and various schemes for the solution of the problem were considered. On the advice of the consulting engineers, the Commissioners decided, in December, 1931, to construct a tidal model of the estuary in order to ascertain the causes of the deterioration of the bar channels and the best means of rectifying the position. The model was made under the direction of the consulting engineers and housed in a building in the occupation of University College, London. The tests began in the autumn of 1932, and were concluded in the summer of 1935.

Before and during the continuance of the model experiments steps were taken to supplement the hydrographic information already available in regard to several matters, including:

- (a) Analyses of the silt content in the tidal waters of the Gulf of Martaban, by observations at various depths, at all states of tide and at the different seasons, and at various distances up to 20 miles from the shore.

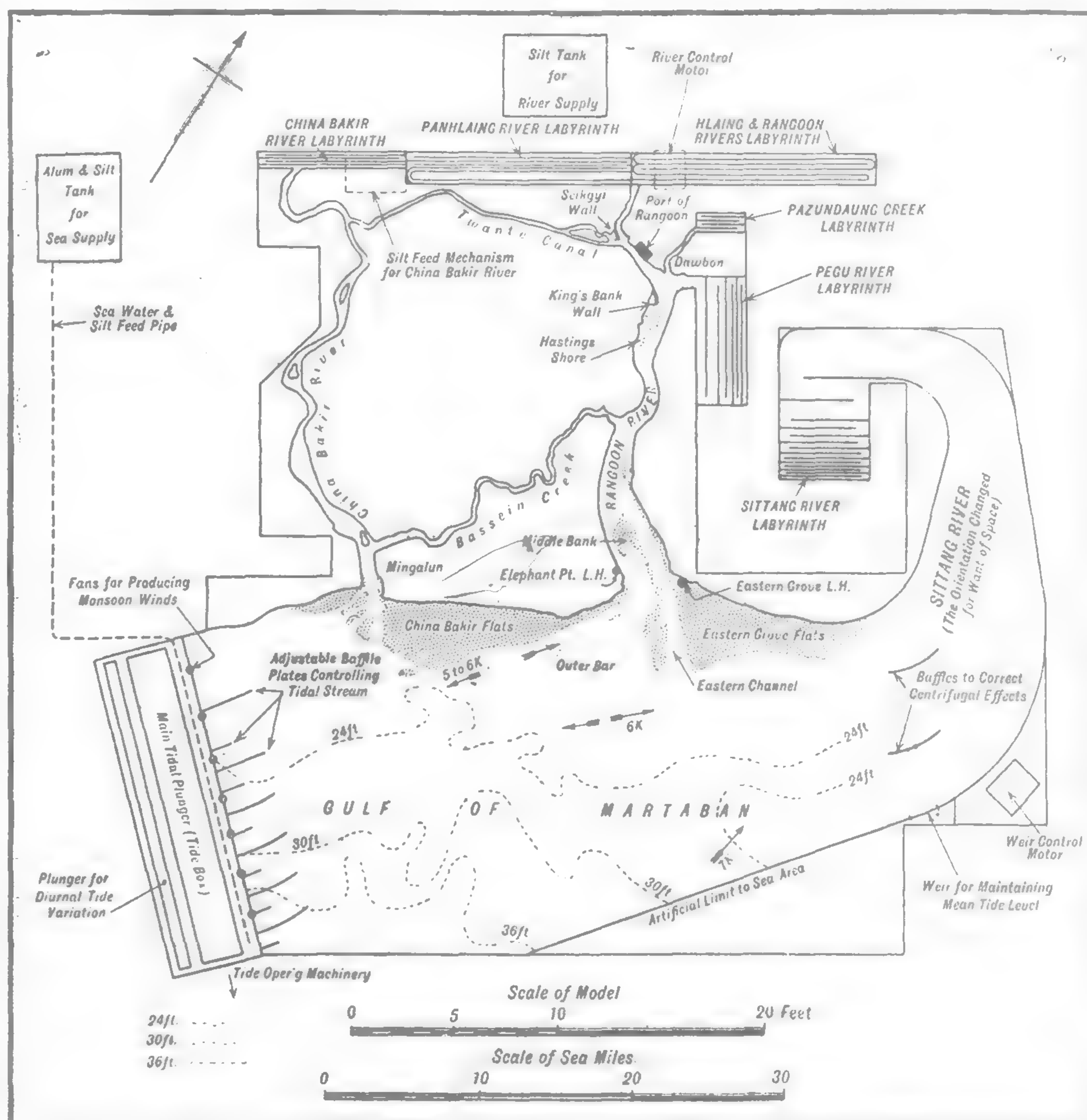


Fig. 1—Plan of the Rangoon Tidal Model

- (b) Similar analyses of the silt content in the lower Rangoon River at points between Ahlon Shoal and Elephant Point.
- (c) A comprehensive and detailed study of both the direction and speed of the tidal currents in the lower Rangoon River and in the gulf in all conditions of season and of tide.
- (d) A series of simultaneous and continuous tide gauge readings to trace the progress of the tidal wave up the gulf and up the Rangoon River.
- (e) Dredged samples of the materials forming the bar and the other silty deposits in its neighborhood.
- (f) Samples of the sand forming the various shoals and banks, both in the harbor proper and at the mouth of the river.
- (g) The composition of the material being eroded at different points on the west or right bank of the lower Rangoon River above Elephant Point.
- (h) Surveys of the Eastern Channel and of the China Bakir entrance.
- (i) Echo-sounding surveys of the Eastern Channel and of the outer bar area.
- (j) An interim report of the hydrometric survey giving more complete and reliable gaugings of upland water than were previously available.

Description of Model

The area included in the model is shown in the plan (Fig. 1). It is larger than the portion primarily under investigation. The inclusion of the Gulf of Martaban out to the six-fathom line and the extensions east and west of Rangoon River was designed to eliminate the immediate unnatural disturbances caused by the tide-generating machinery and by the existence of restricted and artificial bounds to the sea. The inclusion of the Rangoon River up to Rangoon was necessary to control the main source of upland water and allow for study of the interaction between the upper and lower river. The full effect of the various rivers up to the limit of tidal influence—in the case of Rangoon River, 30 miles above the city—was provided for by means of proportioned "labyrinths."

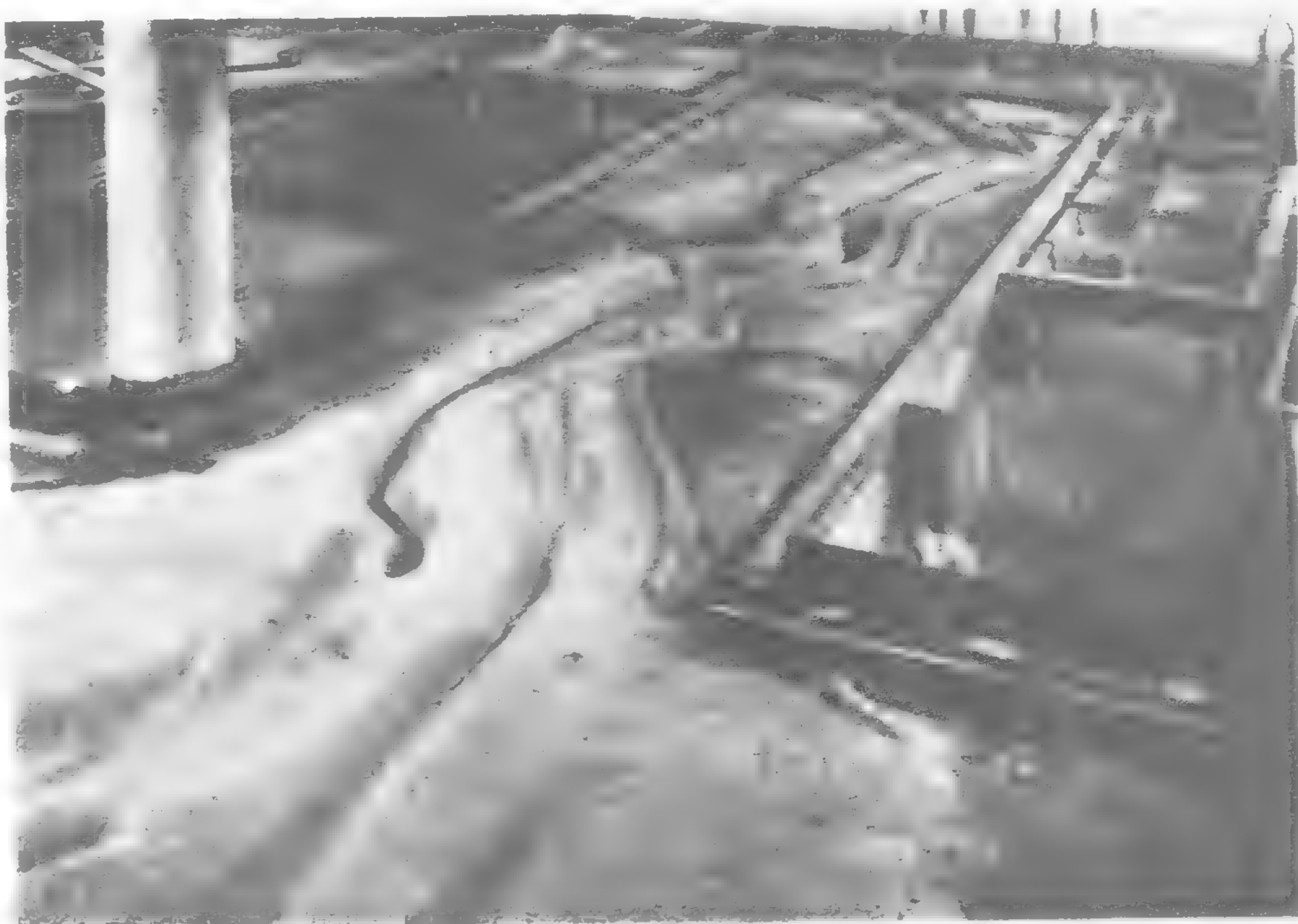
The scales adopted for the model were:—

Horizontal, 1 : 8068 or 9-in. = 1 sea mile.

Vertical, 1 : 192 or $\frac{1}{16}$ -in. = 1-ft.

Vertical exaggeration in model 1 : 42.

Time, $\sqrt{192} : 8068$ 1 : 583.



The Rangoon Tidal Model; Model Moulded to Survey of 1877

Ratio between current velocities in the model and the actual velocities is 1 : $\sqrt{192}$ = 1 : 13.85.

Ratio between settlement of silt in the model and the actual settlement is $\frac{8068}{192} : \sqrt{192}$ = 3.04 : 1.

Tidal period between two successive high waters = 76 sec.

One day = about 2½ minutes in the model.

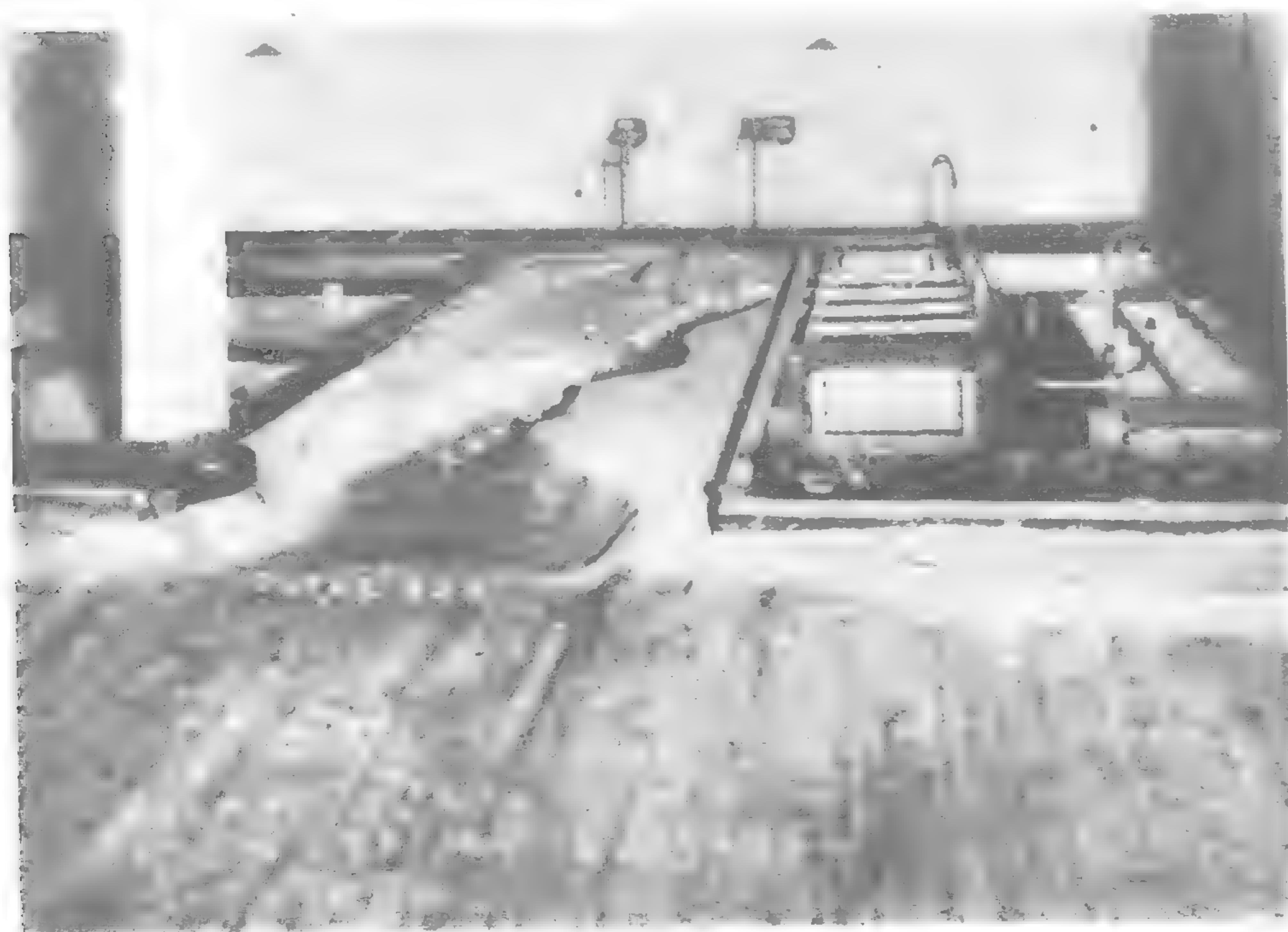
One year = about 15 hours in the model.

A week's running of the model = approximately ten years.

The bed of the model was originally formed of sand of a type shown, by microscopic examination of numerous samples from the bed of the Rangoon River, to represent adequately the characteristics of the Rangoon sand. The banks were subject to erosion and were formed of a composition of sand and clay found by experiment to erode approximately in a similar manner and rate to actual experience. Different colored sands were used for the banks of various parts of the river system to establish the source of materials forming shoals and bars. The use of naturally colored sands for this purpose was impracticable owing to the difficulty of finding natural sands differing in color but similar in size, density, and weight. An artificial permanent coloring agent was evolved that did not materially affect the size, weight, or nature of the grains of sand. The differentiation of the erodible materials was modified later in the experiments, as will be seen from what follows.

The effect of the tides was obtained by immersing a plunger measuring 15-ft. by 2-ft. into a tide box. The tidal variation between springs and neaps was reproduced by epicyclic gearing, which automatically varies the length of the stroke. In the Gulf of Martaban there is also a pronounced diurnal variation, and a smaller plunger, 15-ft. by 4-in., running at half the speed of the main plunger, reproduced this. The tides, it will be noticed, were generated up and down the Gulf of Martaban at right angles to the Rangoon River, and not, as has usually been the case in tidal models, in line with the river flow.

Two tanks were provided for the supply of silt-laden water to the model, one for sea water and the other for river water. The infusion of silt into the river and sea water respectively was controlled mechanically and varied between the dry and wet seasons. In the earlier experiments different colored silts were used for the river and sea in order to ascertain their relative effect on the outer bar. The accelerated precipitation of silt necessary in order to harmonize with the



Condition of the Model September 24, 1932

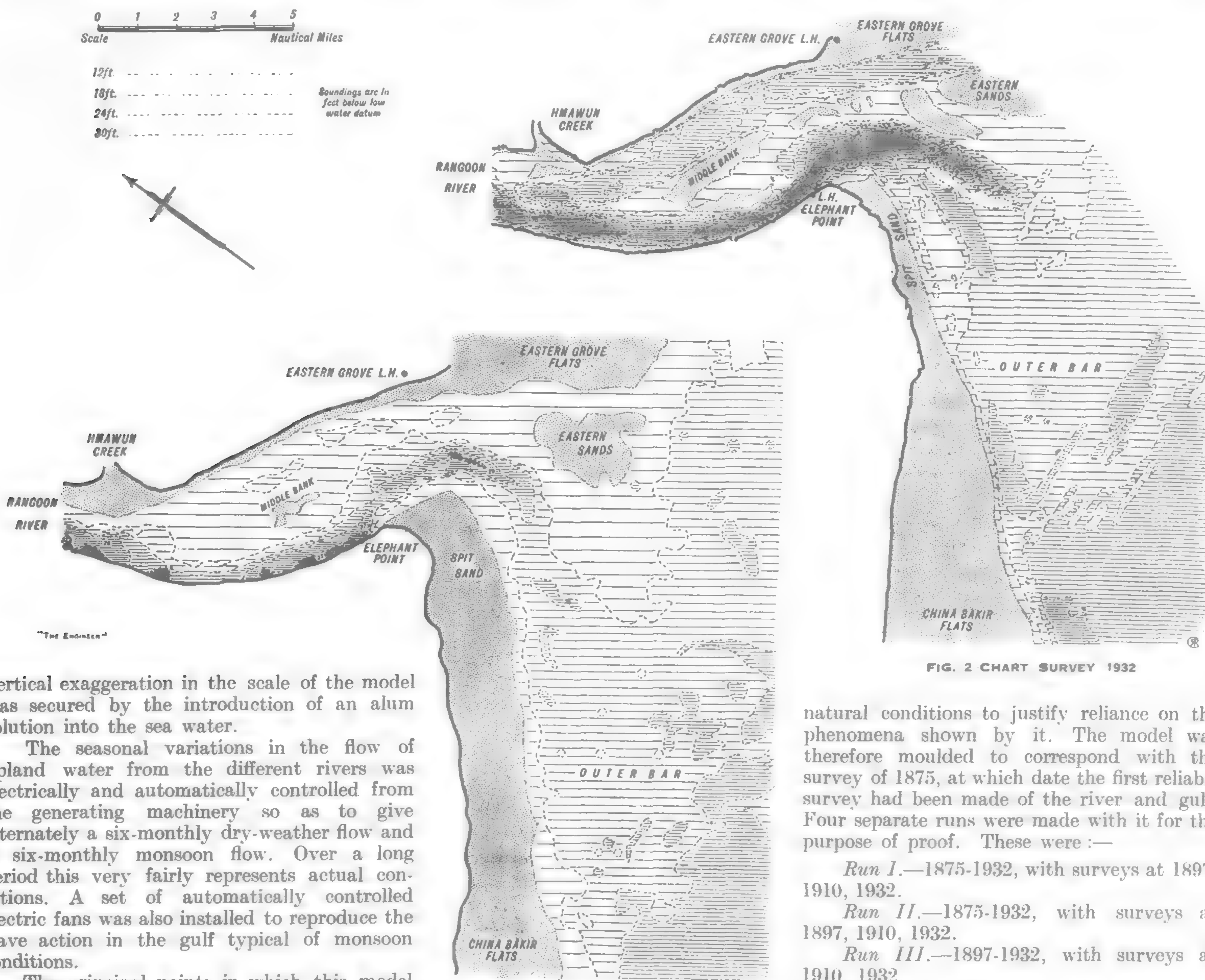


FIG. 2 CHART SURVEY 1932

FIG. 3—SURVEY OF MODEL 1932

vertical exaggeration in the scale of the model was secured by the introduction of an alum solution into the sea water.

The seasonal variations in the flow of upland water from the different rivers was electrically and automatically controlled from the generating machinery so as to give alternately a six-monthly dry-weather flow and a six-monthly monsoon flow. Over a long period this very fairly represents actual conditions. A set of automatically controlled electric fans was also installed to reproduce the wave action in the gulf typical of monsoon conditions.

The principal points in which this model shows some departure from previous tidal models are :—

1. At the time of its construction it was the largest tidal model yet attempted.
2. The propagation of the tides in the estuary at right angles to the outflow of the river.
3. The use of erodible banks (in previous models banks of rivers and estuaries have been formed of rigid materials).
4. The use of different colored sands and silts and, in the later stages, of chemical distinctions.
5. The special arrangements to produce diurnal variation.
6. The automatic control and variation of upland water as between monsoon and dry-weather periods.
7. The variations in silt content as between monsoon and dry-weather periods.
8. The automatic variation of the discharge weir in order to maintain a constant mean sea level.

Proof of Accuracy of Model

The three fundamental questions which, it was hoped, would be solved or, at any rate, elucidated by the exhaustive hydrographic survey and the model experiments were :—

1. What is the actual state and nature of the Outer Bar ?
2. What are the causes of this state, and what are the factors regulating the regime in this area ?
3. What is to be done to safeguard the future ?

It was first of all necessary, in order that reliance could be placed on the results that might ultimately be indicated by the model, to prove that it was a sufficiently close reproduction of

natural conditions to justify reliance on the phenomena shown by it. The model was therefore moulded to correspond with the survey of 1875, at which date the first reliable survey had been made of the river and gulf. Four separate runs were made with it for the purpose of proof. These were :—

Run I.—1875-1932, with surveys at 1897, 1910, 1932.

Run II.—1875-1932, with surveys at 1897, 1910, 1932.

Run III.—1897-1932, with surveys at 1910, 1932.

Run IV.—1875-1932, with surveys at 1910, 1932.

The first run was mainly experimental in character, the chief difficulties to be overcome being those connected with the problem of silt and the great variations between monsoon and dry-weather flow. In no other tidal model had the difficulty presented by vast quantities of silt, as carried by the Rangoon and Irrawaddy rivers, had to be overcome. Further experimental work carried out in the course of the third run eventually solved the silt problem. The reason for this run being started at 1897 was that the more material changes in the outer bar date from years subsequent to 1900.

Run No. 4 was in no way intended as a check on the correctness of the model operation, which had been established by the previous runs. This run was carried through on the same basis as those which preceded it and exactly the same tests and surveys were carried out. Its main purpose was to embody and confirm the methods of chemical investigation of the sources of silt deposited on the outer bar which had been evolved during the third run.

Comparison of the Commissioners' survey charts of 1910 and 1932 with the corresponding tidal model surveys shows general similarity. We reproduce in Figs. 2 and 3 portions of the chart survey of 1932 and the survey of the model at 1932 after it had been run for a period corresponding to 1875-1932.

A comparison of the hydraulic phenomena afforded by Nature and the model respectively showed that the tide curves agreed in the three critical points, viz., range, rate of rise and fall, and rate of travel; while the float traces, both as to speed and direction, showed that adverse effect of artificial factors and unnatural restrictions in the model had been overcome. Volumetric

comparisons of accretion over the outer bar showed a fairly close correspondence between the model and the information available from actual survey records. The difference between actual and model results of siltation was about 15 per cent. The accuracy of any model is governed by mechanical efficiency, on the one hand, and the accuracy of the data, on the other. An overall mechanical efficiency of 90 per cent is as high as can be expected, and the accuracy of the hydrographic and physical data on which the model operation was based is probably less than 80 per cent.

The marked increase in the rate of accretion on the bar subsequent to 1910, which has occurred in Nature, was well reproduced in the model. This accretion appears to consist almost entirely of a blanket of fine silt overlying firmer material which formed the bar surface at the time of the 1875 survey and which appears to have remained almost unchanged since. At one time this underlying material, the varying levels of which were determined by echo sounding, was believed to be compact sand. Subsequently it was definitely established that the bottom is everywhere silt and mud, soft on top and of increasing compactness with depth.

The following table shows the average depth of silt accretion shown by actual surveys and the model respectively from 1875 :—

Silt deposition on the Bar over an area of 20 sq. sea miles

	1875	1918	1932	
Actual average depth of silt in feet ..	0	3' 2"	6' 2"	100%
Model depth in feet ..	0	2' 8"	5' 3"	85%

The only material point in which the model did not succeed in reproducing actual conditions is in the Eastern Passage, which in the model has consistently tended to fill up. The mechanical maintenance of deep narrow cuts or pockets in a river bed is a matter which presents difficulties in any hydraulic model with an exaggerated vertical scale, and especially where a heavy silt content is also in existence. Furthermore, the existence of a deep cut in a position at right angles to the main tidal stream and silt drift in the gulf appears to be an unnatural condition of affairs, and it is probable that the model has merely accelerated the deterioration of the Eastern Channel that is actually occurring in Nature. Fortunately, the crucial area in this model—the outer bar—was free from this particular difficulty of reproduction.

Investigation of the Origin of Silt on the Outer Bar

Experiments with echo sounding equipment on the outer bar have shown that the bar consists of an uneven, firm lower bed (now known to be compact silt and mud), covered in unequal thicknesses by an overlying blanket of very soft material presenting a more or less even surface. This blanket varies from 2-ft. to 8-ft or 10-ft. in thickness and consists of very fine soft mud. It appears probable that the recent growth of the bar has been almost wholly due to increased

deposits of this material. The experiments made to determine the origin of this mud or silt are of great interest. An attempt was made to do this by making use of different colored sands and silts deriving from the several possible sources, e.g., tidal silt from west of the China Bakir; the several rivers, China Bakir, Rangoon, Pegu and Sittang; and from the erodible bank of the Rangoon River. The initial experiments were not altogether satisfactory and the results were inconclusive. Later, two types of silt were found which were mechanically similar, and reacted equally to the hydraulic regime of the model, but had different chemical compositions, one containing a considerable proportion of titanium dioxide from which the other was free. A further distinction was afforded by introducing Prussian blue in some of the silts. From the results of these experiments the following general conclusions emerged :—

1. The general travel of silt in the Gulf of Martaban is from the west to the east.

2. The effect upon the outer bar of silt issuing from Rangoon River is small.

3. The general make-up of the bar is at least 75 per cent from west of the China Bakir, i.e., Irrawaddy silt, with possibly up to 10 per cent China Bakir silt and 15 per cent from Rangoon River.

This general easterly "set" was further corroborated by the almost invariable ultimate destination of both floats and color matter, coming out of the Rangoon River, on to the Eastern Flats and towards the Sittang River.

Among other matters investigated by means of the model were the progressive changes which have been produced in the tidal streams over the bar by changes in the mouth of the Rangoon River. From the results obtained the following tendencies were apparent :—

1. In the river there was a slight tendency to an increased ebb velocity, accompanied by a decreased flood velocity.

2. Over the bar there was a slight tendency to a decreased ebb velocity, accompanied by an increased flood velocity.

Bank Erosion

One of the innovations introduced into the Rangoon model was an attempt to reproduce naturally the changes in the lines of the banks. On certain sections of the Rangoon River erosion has frequently amounted to about 100-ft. per year over long periods, and the method of fixed vertical banks hitherto adopted in models introduced in such a case an unnatural factor which it was desirable to eliminate. A mixture of material for the banks was devised which allowed the erosion to proceed systematically; but

the slopes failed to maintain the extreme steepness required. In the last two runs of the "proof" experiments an artificial method of erosion at Elephant Point was introduced in order not to prejudice the silt observations. In moulding the western bank of the river a special clay was used that resisted erosion, but was capable of

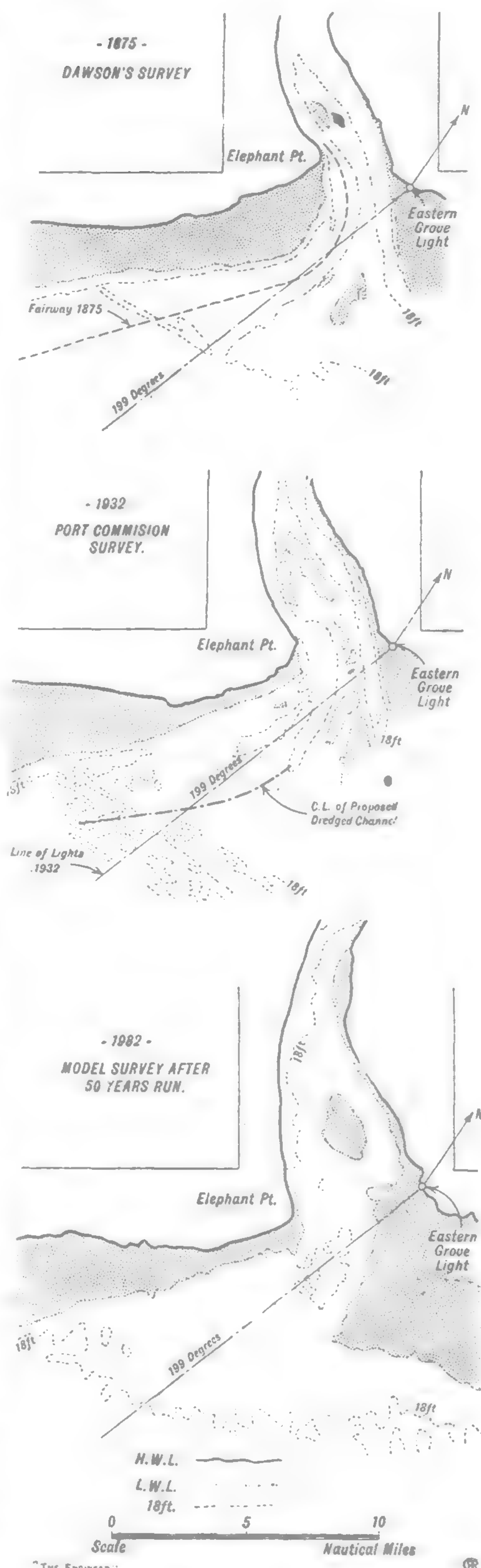


FIG. 4—SURVEYS OF THE MOUTH OF RANGOON RIVER

being cut back regularly to conform with the natural changes, the equivalent amounts of silt and sand being introduced at short intervals at the appropriate tidal periods and in the proportions indicated by the information available as to the composition of the bank material.

Conclusions from "Proof" Experiments

The foregoing summary of the results of the preliminary or proof runs of the model showed, as we have already indicated, that the soft mud overlying the older and more compact material of the outer bar is a growth of the past thirty years and is comprised, for all practical purposes, of Irrawaddy silt, i.e., silt from sources west of the Rangoon River. Neither the Rangoon River silt nor the Sittang silt plays any material part in its formation. These conclusions are of fundamental importance to any study of the measures to be taken for the solution of the problem. Prior to the model experiments many authorities believed that a large part of the Rangoon silt went to swell the volume of the outer bar. The consulting engineers, in their interim report to the Commissioners on the conclusion of the 1875-1932 runs, stated, in reference to this matter of the origin of the bar silt, that, after repeated checks of all the factors, they accepted the results as conclusive. In this matter, their findings confirm the views as to the origin of the silt which have always been held by the present chief engineer to the Commissioners.

Tidal Model Investigation of the Future

We now come to the series of experiments carried out with the Rangoon model to explore the probable natural evolution of the river from the date of the 1932 survey up to the year 2015 and to test the possibility of artificial remedial measures. This series of experiments was begun in November, 1934, and the model was run periodically until July, 1935. The results of the tests are described in the final report of the consulting engineers placed before the Port Commissioners in April, 1936.

The technique of the later runs of the model did not materially differ from that already described, except in regard to the reproduction of the erosion of river banks and the composition of the sea bed in the model. To overcome the difficulty that the actual rate of erosion of the river banks above Elephant Point could not be accurately forecast in these runs into the future, the following procedure was adopted. In the first of the main predictive runs the bank at Elephant Point was artificially cut back at half the average rate that had actually obtained between 1910 and 1932. During the final run the rate of erosion allowed for was at the average rate that obtained between 1875 and 1932. This was about ten times the magnitude of the former. It was considered that the truth must lie somewhere between these limits. But the experiments have clearly proved that erosion at Elephant Point does not have the marked effect on the outer bar that was generally assumed, and is, in fact, only a minor factor in the problem.

In the early runs the sea bed in the model had been moulded with clean sharp sand which was considered likely to represent the state of the bed in 1875. Further investigation by the Rangoon port survey department showed that in 1875 the sea bed in the vicinity of the bar would have been mainly silt as it now is. In starting the predictive runs, therefore, the sea bed of 1932 was successfully reproduced in silt.

The main predictive runs covered a fifty year period, 1932-1982, with a break at 1951. The model was also operated up to the year 2015, the effect being accelerated by exaggerated doses of silt during this further period.

Indications Afforded by the Model

The principal points noted from the predictive runs of the model were:

- (a) Progressive and steady growth of Eastern Grove Flats.
- (b) Increasing tendency of the river to adopt the more southerly course that was already beginning to develop in 1932.
- (c) Progressive deterioration of the Eastern Channel, until in 1982 it no longer exists as a channel.
- (d) Widening of the middle bank as the western shore recedes.
- (e) Slow, but steady, increase in the China Bakir Flats.

(f) Sandy shoals developing to the southward of Elephant Point, corresponding to the East and West Swatch banks in nature.

(g) The distance between the 18-ft. contours in the river and those in the gulf did not appreciably change during the period under study.

The 2015 year experimental run indicated a further development of some of these tendencies. Generally, from the point of view of the approach channel to the port, the position in 1982 was shown by the model to be certainly not worse than it was at the date of the report, and the state of the outer bar was no more serious or more threatening than in 1931-1932.

The consulting engineers, in their final report, make the following comment on the conclusions to which the model experiments point. "It is not necessary," they say, "to accept these results blindly. Consideration of some of the factors which have always been at work, but which have not been so obvious until elucidated by the model, will show that there are sound reasons for the above conclusions. The most noteworthy and satisfactory development is perhaps the eastward swing of the main channel, because in many ways this offers the most promising conditions for navigation in the more immediate future.

"The principal factor governing the tendency of the Rangoon River to flow more southerly, instead of swinging sharply to the west, is the growth of Eastern Grove Flats. When these are submerged in the higher stages of the tide, the set of the ebb stream out of the Rangoon River is south-westerly, following the general direction of the ebb-tide currents in this portion of the Gulf of Martaban. As the Eastern Flats uncover, however, they become by about half-tide a barrier protecting the ebbing river current from the influence of the main stream in the gulf, and thus the river ebb is to some extent more capable of maintaining the natural southerly trend that the generally, straighter course at the mouth involves. This, it will be realized, occurs at the stage of the tide when scour is most effective.

"The Eastern Channel, according to the model, is doomed to disappear. Indeed, its continued existence in Nature for so long a period is surprising and not easy fully to explain: but recent surveys seem to corroborate the model results, and we feel that its deterioration is now likely to become more pronounced. As a channel of approach to the Port of Rangoon, it is not seriously to be thought of.

"The development of the swatch ways has recently come into prominence. According to the latest survey, the Western Swatch has or had 13-ft. to 14-ft. at low water, and the possibility of its becoming an approach channel to the port has been mentioned. From consideration of the model results, the development of a good channel in this position appears only to be temporary, as might be expected. The heavier material carried out of the Rangoon River on the ebb drops almost entirely to the southward of Elephant Point, and so forms the shoals through which the swatch ways are cut at the early stages of the ebb tide. But the whole coast line is moving seaward in a normal deltaic manner, and while the swatch ways may be a continuing feature, they will not, at least according to the model results, ever provide a permanent channel."

Summing up the results of the experimental work and research as to the future of the Rangoon River, the consulting engineers say: "The river, and particularly the area of the approach channels, must inevitably go through cycles of change. The Rangoon River is bound to exhibit the meandering tendencies common to alluvial rivers. Our experimental work shows that its present phase is one of straightening from the highly sinuous stage of 1875 to a relatively straight alignment. In due course, this will break down and cause a repetition of the 1875 stage, slightly further to the west, and much further seaward. In the interim stages of such changes, when the channels are adjusting their positions fairly fast, they are more indefinite, and show varying degrees of deterioration. We are now in an interim stage. The next major change should be rather toward improvement than the reverse. In saying this, we assume—as we must—that the fresh-water discharge of the Rangoon River and its tidal compartment will remain pretty constant: and on this assumption it appears to us as a result of our investigations reasonable to expect the approach channels not to become materially worse than in 1932, but possibly not for a considerable period, if ever, to become again as clearly defined or as good as in 1875."

We reproduce in Fig. 4 a chart of the model survey of the bar for 1932 after the run under maximum conditions of erosion above Elephant Point. For comparison, there are also reproduced in Fig. 4, to the same scale, parts of the Commissioners' survey chart for 1932 and of Dawson's survey, 1875. The deterioration that has taken place since 1875 is clearly shown by comparison of the 1875 and 1932 charts.

Probable Effect of Artificial Works

So far, the work carried out by means of the model which we have briefly summarized was confined to the elucidation of the future of the river mouth if left entirely to the operations of Nature. But, in addition to these investigations, experiments were made to learn what might be effected by artificial works, particularly by the construction of training works or by dredging along a suitably aligned channel. The description of these experiments, contained in the final report, is much too detailed to quote in full, and without reference to the large number of model charts illustrating the results obtained, a summarized account would be of little value. As to training works and revetments, the opinion of the engineers, based on the experiments, is that none of the alternative schemes tested would have any material or lasting effect on the outer bar as a whole. "Even the most elaborate and costly system of training walls," they say, "could not have a permanent effect."

Dredging

The model, as we have indicated, was also employed to "show whether, if dredging on the outer bar be possible, the resulting effect is likely to be beneficial or not, and whether permanent or merely temporary." The location of the dredged channel through the outer bar in the model was chosen so as to follow the route that the natural channel seems to be tending to adopt, and then allow the natural scour to assist both the initial dredging and the maintenance of the channel. The dredging results were almost surprisingly definite. "A model of this scope and scale cannot ordinarily do more than indicate tendencies, and enable alternative engineering schemes to be tried out at little cost and no risk. But within its limitations, a model is a scientific piece of apparatus of great value in research, and to its scientific conclusions due weight must be given. Contrary to what might seem likely to an actual observer of the area of the outer bar, it appears that a dredged channel formed in the area, provided it is aligned to conform with the general run of the currents, will have a long-standing effect. So far as the model can indicate, the channel will by no means fill up as fast as dredged—as has been suggested. The prospects for dredging are, in fact, more favorable than in many cases where it has long been successfully employed. It was clearly shown by the model experiments that it would be possible to have a dumping ground close at hand, that would not in any way threaten the dredged channel over the bar, or the river itself."

Conclusions

The consulting engineers state their conclusions on the investigations as a whole as follows:—

- (a) The Port of Rangoon is not threatened by eventual extinction.
- (b) In the ordinary natural course of events some limitation on the draught of the vessels using the port will be inevitable unless rectification by artificial means is carried out.
- (c) There seems no reason to suppose that conditions should ever be materially worse than in 1931.
- (d) In this respect it will not compare unfavorably with some of the most important ports, such as the Port of Calcutta.
- (e) If, however, the Port of Rangoon is to make certain of its future, some steps are advisable to assist the efforts of nature to maintain a good channel.
- (f) Training works are not justified.
- (g) Some initial capital dredging and a not excessive amount of maintenance dredging would suffice to make reasonably certain of a satisfactory and permanent approach channel.
- (h) Assuming successful results from such dredging, it should not be outside the port's capacity to improve the channel and provide permanently a greater depth of water, if such were required and justified, than has been at any time regularly available during the last thirty years.

Finally, the engineers recommended the dredging of a channel across the bar having a bottom width of 200 yards. The formation of the channel, to give an increase in depth of 3-ft., would mean dredging about 3,000,000 cubic yards of material *in situ*, and occupy four or five working seasons. The cost of the work, exclusive of expenditure on future maintenance dredging, is estimated at £247,000. The center line of this proposed dredged channel is indicated on the sketch chart of 1932 reproduced in Fig. 4.

The Rangoon Port Commissioners' Decision

When the consulting engineers' report was considered by the Commissioners in the spring of this year particular attention was directed to the question of dredging on the outer bar. In its physical aspect, the Commissioners doubted whether it was desirable to carry out, under the conditions existing, a dredging program of such a magnitude. In regard to the financial implications of a dredging scheme, the Commissioners, in the memorandum recently issued by them to which reference has already been made, state that "it was clear to them, assuming that the Rangoon River was likely to remain for a considerable time a natural channel of approach for vessels drawing up to 28-ft., that any program of dredging would benefit only a comparatively small percentage of the vessels which now use the port. The question was therefore whether there was sufficient justification for embarking upon a program of dredging involving a considerable burden upon port funds which would have to be borne not only by the comparatively small number in whose interests the improvements would be carried out, but also by the large majority who would not be affected by any increase in the available depth of water, as well as by general users of the port. . . . The Commissioners realized that there is a point in port development at which economical consideration must impose a limit upon the draught of shipping, and that the prosperity of the port might be prejudiced just as much by heavy charges as by physical obstructions. They decided therefore not to proceed with major dredging operations over the outer bar."

* * *

Scale Models

Supplementary to the foregoing an editorial expression of interest with regard to the value of scale models is printed in the same number of *The Engineer* in which the article appears. This is as follows:

Experimental investigation by means of scale models has in recent years become a matter of general practice in the preliminary work associated with many forms of engineering design and construction. The systematic experimental study of the problems involved in the interaction of solid bodies and fluids in relative motion begun by Froude many years ago has been so far developed that no important innovation in design affecting the hull form or propellers of a ship is now adopted without preliminary model experiments in a tank. The designer of aeroplanes is dependent on model experiments equally with the naval architect, and in the design of hydraulic works such as weirs, sluice gates, spillways, locks, and the water passages of hydraulic power machines, scale models are being increasingly employed with successful results. In the United States of America and elsewhere earthquake upheavals and their effect on buildings and structures are being studied by models: the usefulness of wind tunnels, with which modern aerodynamical laboratories are now equipped, has recently been extended to the investigation of wind pressure effects on "skyscrapers" and windmill vanes, and in still another field of engineering science models of high-speed, streamlined locomotives are being tested not only in relation to air resistance, but to investigate various oscillatory movements set up at high speed. In all these cases the experimental technique has been so developed and perfected that, provided suitable precautions are taken, reliance may safely be placed on the data obtained from the model tests in designing the full-scale work. It is generally practicable in scale models of hydraulic structures of the classes to which we have referred to avoid the difficulties and complications associated with the distortion due to widely differing horizontal and vertical scales. This is an advantage, or, rather, the avoidance of a disturbing factor, which they share with the experimental models ordinarily employed by the naval architect, the aeronautical designer, and the mechanical engineer.

As far back as 1885 Osborne Reynolds constructed the first tidal model of the Mersey estuary; his work forms the basis of all later experimental work with tidal models just as the operation of the modern experimental tank for ship models has been developed on the foundation laid by Froude. But in models of tidal estuaries and rivers it is impossible to avoid distortion of scale and this statement also applies to most scale models of uniflow rivers. Models of such rivers are now extensively used, especially in the hydraulic laboratories on the Continent of Europe and in America, to investigate problems of bed erosion and the probable effect of works designed to improve navigable channels. It is in tidal models that the unavoidable disparity of the vertical and horizontal scales is of special importance, and has raised doubts in the minds of experienced engineers as to the value of the experimental results obtained from them. The late Sir Frederick Palmer, in the course of the discussion on a paper describing a scale model of Bombay harbor read before the Institution of Civil Engineers nearly six years ago, ridiculed the sand slopes which in Nature were one in ten and became, in the model, $7\frac{1}{2}$ vertical to one horizontal. He laid emphasis on the obvious fact that the fine grains of sand used in the model were 3-ft. in diameter on the scale of the model. He rejected the view that "results with models made to such a distorted scale could really serve as a guide under natural conditions." Sir Frederick's utterances were usually characterized by sound practical common sense, and due weight must be given to the opinion of a man of his experience and distinction. Few engineers qualified to form an opinion would, however, in these days, condemn tidal models in such emphatic terms as those used by Sir Frederick Palmer. In spite of the disturbing factors inherent in such experiments it is now generally recognized that they do afford information of a qualitative nature as to the probable effects of artificial works in an estuary or tidal river and as to the progress of natural agencies. Mr. Maurice Wilson and Captain F. W. Mace, who have had considerable experience of the working of the Mersey estuary and other models, have testified that it has been possible to obtain from them a good general idea of what was likely to happen. For instance, the currents generated in the Mersey model at Liverpool reproduced almost identically those in the Bay, and the general effect of the training walls made in the estuary was correctly reproduced in the model. But it failed to give reliable quantitative indications of the depth of scoured channels or the height of banks. In one set of relations the phenomena

of Nature have been quite accurately simulated in many tidal models in spite of scale disparity—that is, in reproducing the flow and ebb of the tides and in the prediction of changes in the tidal régime as a result of artificial interference with Nature. The model of the Cape Cod Canal, for instance, afforded valuable and accurate data of the modifications of the tidal flow in the waterway which might be expected to follow the enlargement of the canal channel and the deepening of the approaches.

The description of the Rangoon River and estuary model, shows that it was made to scales which are very similar to those adopted by Dr. Gibson in his well-known models of the Severn and Humber estuaries. The vertical exaggeration in the Rangoon model is 1 : 42; in the final model of the Severn 1 : 42.5 was used, and in the Humber model the ratio was 1 : 37. In the Rangoon model several improvements in technique were introduced, one of the most interesting being the successful differentiation of the silts derived from several sources. The effect of monsoon winds and wave action was simulated by the use of batteries of fans, a refinement of technique first introduced, we believe, in one of the Mersey models at Manchester University. The steps taken by those responsible for the Rangoon model to prove its general accuracy by repeated preliminary runs representing fifty-seven years from 1875 to 1932, are of especial interest. The correspondence between the actual surveys of the estuary and the model surveys at various dates is remarkable: the measurements of silt accretion on the bar in the course of fifty-seven years was, in the model, on the average, 85 per cent of the actual average accretion shown by the survey charts of the same period. Such a result as this goes a long way to establish the credibility of the model's forecast of the future history of the bar and estuary. The only material point in which the Rangoon model did not succeed in reproducing actual conditions was one of the deep narrow passages in the estuary, which in the model consistently tended to fill up. It is in such circumstances that the exaggerated vertical scale in a hydraulic model must inevitably give discordant results and be unreliable especially when a heavy silt content is also in existence. Tidal and river models, in spite of all the reservations that must be made in regard to some of their indications and their inherent quantitative fallibility, are of definite value if used intelligently. The technique of construction and operation of such models has been vastly improved in recent years, and that they will be increasingly used in the future seems to us to be a certainty.

Tungsten in the Far East

(Continued from page 543)

in particularly with Chinese methods, and within a short time shipments of concentrates were large enough first to dominate and then to break the market. High grade concentrates can be laid down in New York or European ports cheaper than from any other district. Much of the richer, easier-mined material has already been marketed, but it is presumed that large quantities remain, and for a considerable period China may be expected to rank first among producers.

According to H. Foster Bain (*Ores and Industry in the Far East*), the important deposits in China are in the south-east. W. H. Wong recognizes two tin-tungsten belts, one near the coast and extending down through Fukien; the other, and more important, extends along the border line between Kiangsi and Hunan on the north and Kwangtung and Kwangsi on the south, running on into Indo-China. It is the same belt in which the tin deposits are found, and the mode of occurrence is the same, tin and tungsten coming often from the same veins. It is reported that the principal center of tungsten production is at Yao Kang Hsien in Hunan, where a mass of granite is intruded between limestone and quartzite. There are many quart-tungsten veins in the quartzite but not in the limestone. Toward the east, tin replaces tungsten.

The book from which the above paragraph was taken was written several years ago, and nothing is said of recent developments. The predictions made, that large quantities of tungsten ores remain, are apparently justified by present conditions. More about the Kowloon deposits will probably be released to the public from time to time as the Marsman interests carry on work there.

Tungsten is essentially a war material; and the present tendency of the nations of the world to prepare themselves for war has undoubtedly favored the tungsten market.

NOTE:—In preparing this article, use was made of, and quotations taken from the *Mining Journal*, of London; the *Engineering and Mining Journal*, of New York; *Ores and Industry in the Far East*, revised and enlarged edition, by H. Foster Bain, for which acknowledgment is hereby made.

Railway Progress in Indo-China

(Continued from page 530)

Mr. Howard made no mention of this line. He did not mention that China, facing a blockade, would be in a most precarious position as far as securing much-needed supplies and materials in time of war are concerned. He did not point out that securing such supplies from, by way of supposition, the Soviet Union would be next to an impossibility. He did not comment on these details, which to even the casual observer are most obvious.

Because of the relative remoteness of Indo-China, often little attention is paid to engineering developments there. When a broad view of the Far East is taken, the strategic importance of the areas bordering South China come into sharp relief. In time of stress, Indo-China and adjoining countries may play a decisive rôle. And in time of peace, their railroads, ports, and transportation facilities, the development of which is quietly but steadily proceeding, will open up much-needed new avenues to the exploitation of South China's rich natural resources, contributing a major share in the development and prosperity of the modern Chinese Republic.

Engineering Notes

INDUSTRIAL

FUEL CONCERN PLANNED.—Japan's three largest business institutions, Mitsui, Mitsubishi and Sumitomo, have decided to found a Fuel Resource Investigation and Exploitation Company, dividing the expense, Y.5,000,000. The plan will be announced shortly. The company will be established as an aid to national policy, calculated to promote the solution of the fuel question.

AUTOMOBILE INDUSTRY.—With the recent adoption of the Automobile Industry Bill in the Japanese Diet, the Nissan Automobile Manufacturing Company proposes to start manufacturing cars for the mass. The company already has decided to purchase a tract of 100,000 *tsubo* for Y.4,000,000 on a 10 year instalment plan at the Tsurumi reclaimed ground, Yokohama. Its present factory there is too small.

CHEMICAL FACTORIES.—Mitsubishi interests, which have always been more or less concerned with mechanical engineering, have decided to go into the chemical industry in a big way. The Japan Tar Industry Company, founded in 1934, with a capital of Y.5,000,000, is to be the instrument. In addition to tar the concern is to make dyestuffs and fertilizers. As a result, large factories are likely to be built at Yawata.

FISHING INDUSTRY.—The Soviets have decided to undertake open sea fishing in Kamchatka this year, and already have sent a 16,000 ton floating cannery from the Black Sea, the largest of its kind in the world. The ship is accompanied by 20 fishing boats. Japanese Government authorities say that open sea fishing in Kamchatka was initiated by Japanese, and they doubt the success of the Soviets, considering they must employ Japanese fishermen.

JAPAN IRON PLANS.—Productive capacity of the Japan Iron Manufacturing Company is to be increased to 5,000,000 tons for finished steel products, 5,500,000 tons for pig-iron and 1,000,000 tons for scrap iron by 1940, as the result of the new five-year plan. The plan was approved recently, the argument being advanced that there is now a universal tendency for increasing armaments, and that Japan should be prepared to keep step. Expenditures necessary are set at Y.200,000,000. The plan envisages absorption of all outside companies within the next five years.

FERTILIZER PROJECT.—With the object of reducing the import of chemical fertilizers into China, the Chekiang and Kiangsu provincial authorities have jointly adopted a policy of government control over the manufacture and distribution of chemical fertilizers, and as a result of a recent conference in Shanghai, a chemical fertilizer plant is to be established in Kiangsu. The plant is to be a commercial enterprise under government supervision. Its initial cost has been fixed at \$300,000. For the site experts suggest Haichow on the east Kiangsu coast as most suitable by reason of the large quantity of phosphorus produced there and its communication facilities.

RAILWAYS

RAILWAY EXTENSION.—The Canton-Hankow Railway will be extended in the near future from the Canton terminus to Whampoa, for the development of which harbor, the Kwangtung provincial government has allotted \$1,000,000.

NEW LOCOMOTIVES.—Sixteen new locomotives, jointly purchased by the Lunghai and the Canton-Hankow railway administrations, arrived at Tsingtao from Belgium on Friday. They were handed over to the engineers of the two lines.

AIR CONDITIONED COACHES.—Air-conditioned railway coaches are to be used on the day run between Penang and Kuala Lumpur, one each way. If they are a success, the present stock of coaches will gradually be replaced by more air-conditioned coaches for the day run, and then for night journeys also.

STEEL CARS.—Because of a recent train collision near Akihabara Station, Kanda, in which nine persons were badly injured, officials of the Tokyo Railway Ministry decided, on June 3, to replace in the next six years the 578 wooden cars still in use on electric trains. A wooden second-class coach suffered the most damage in the collision. Under the program Y.1,000,000 will be spent annually for six years in providing the cars with steel bodies.

NEW SOVIET RAILWAY.—The laying of the last kilometers of the railway from Uralsk to Iletzka, a distance of 263 kilometers, was completed on September 29.

The new railway is the shortest connection between the Donetz Basin, the Northern Caucasus and the Lower Volga Region, and the republics of Central Asia and Kazakhstan.

RAILWAY SOLD.—The Poshan-Changtien Light Railway which has been acquired by the Kiaochow-Tsinan Railway administration from the private owners for the sum of \$780,000 was formally taken over recently by Mr. Sung Jo-yu, member of the Administrative Committee of the Kiaochow-Tsinan Railway, on behalf of the Administration.

Work for the conversion of the line into a branch of the Kiaochow-Tsinan Railway will be started immediately and is to be completed by next spring.

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COMMUNICATIONS

HIGHWAY IN HUNAN.—A total of 195,947 kilometers of highway has been built in Honan province, according to figures compiled by the Provincial Department of Reconstruction. There are now 80 omnibus stations in that province.

NEW HIGHWAY.—The new Hunan-Szechuen highway, which is one of the seven proposed main trunk lines radiating from Hunan province, has been completed and will formally be opened to traffic in November. The road links Yuanling with Yungui, a distance of over 325 li. The highway cost around \$1,800,000.

HIGHWAY CONSTRUCTION.—The Shensi Provincial Government has decided to allot \$671,298 as expenses for the second stage of the engineering work for the Weihui Irrigation Canal project in Northern Shensi. It has also decided to commend the District Magistrates of Suiteh and Michih for their strenuous efforts in highway construction.

RECONSTRUCTION LOAN.—The municipality of Peiping has decided to issue bonds for a loan of \$3,000,000, the proceeds of which will be used for reconstruction work in the ancient capital. The Ministry of Finance has granted permission for the flotation of the loan, and subscriptions will be open when the Executive Yuan has approved the regulations governing the issue.

TOKYO SUBWAY.—Completion of a subway connection in Tokyo between Asakusa and Shinjuku, by way of Shimbashi, before the end of next year is envisaged following reports that the Japanese Railway Ministry intends soon to sanction construction of the line between Shinjuku and Akasaka Mitsuke. Permission has been held up for some time partly through fear that driving the subway under the outer moat between Akasaka Mitsuke and Yotsuya Mitsuke would damage the aged pines trees and possibly affect the water level.

SHIPPING

RECLAMATION IN PENANG.—Reclamation of 152,460 sq. ft. of foreshore in Penang, with the purpose of evacuating the wood merchants from Weld Quay to that site, is to be undertaken. The Municipality is to construct a 40 feet street through the reclaimed area, three 40 feet access streets, a 15 feet back lane and drainage construction.

HULUTAO HARBOR WORKS.—Work on the development of Hulutao Harbor, interrupted since January, 1932, will be resumed this year. The Director-General of Manchoukuo Railways has allotted 40,000,000 dollars to complete the entire project in four years, but will spend only the 370,000 dollars this year to install a water supply system, and consolidate the existing piers.

S.S. MACOMA.—The single-screw motor tanker *Macoma*, built by a Dutch firm for the N.V. Petroleum Maatschappij La Corona, is 483-ft. overall and 460-ft. b.p.; is 34-ft. in depth and 59-ft. in breadth; and has a displacement of 16,660 tons in loaded condition. Constructed according to the combined longitudinal and transverse framing system, she is equipped with a Werkspoor single-acting four-cycle eight cylinder supercharged oil engine developing 4,000 h.p.

KOWLOON NEW CRANE.—A contract has been secured by Messrs. Gammon, Ltd., for erection of the reinforced concrete substructure for a 100 ton crane at Kowloon Docks. This entails building four concrete columns, eight feet in diameter, and braced by heavy decking and anchor beams to the shore. The columns will stretch to the dredged sea bed 43 feet below sea level, and will be supported on four independent footings, 24 feet square, with 36 inch Vibro piles in each. The Vibro Piling Company, Ltd., has successfully completed all the Vibro piling work—the first occasion that such piles have been driven completely under water.

BIG DRY DOCK.—The South Manchuria Railway Co., which owns and operates the entire shipping facilities of Dairen, is to build a dry dock capable of accommodating vessels up to the 10,000 ton class. The dock will be at Kanseishi, across Dairen Bay from the city, and will cost Y.5,000,000. Kanseishi is a recently developed suburb of Dairen and the home of such industrial establishments as the Manchuria Chemical Industries Co. and the Manchuria Petroleum Co. The only dry dock in Dairen at present is one owned by the Dairen Kisen Kaisha, which can handle ships of about 4,000 tons.

SHANGHAI'S NEW WHARF.—A \$7,000,000 project to furnish better shipping facilities at Shanghai has been launched. The construction of the Jukong Wharf below Point Island in the Whangpoo has just begun. When the first of the three stages is completed in a few months, there will be two sections of reinforced concrete wharves with a total length of 1,180 feet and over a frontage of about 1,500 feet, four warehouses, one office building housing the wharf offices, Customs Examination Rooms, passengers' waiting rooms and several residences. The storage space will amount to roughly 15,000 tons.

JAPANESE BUILDING MORE VESSELS.—With 120 vessels, aggregating 769,100 tons, ordered or on the stocks, Japanese shipyards to-day looked forward to a period of prosperity.

According to a check, nine vessels, totalling 83,000 tons, were ordered during the period of August 15 to 30.

The Kawasaki Dockyards led the list with seventeen vessels, totalling 161,000 tons, under construction or in the blue-print stage. The Mitsui Tama yards came second with 21 ships totalling 147,500 tons.

Others were the Mitsubishi Dockyards, Nagasaki, 14 vessels, 117,350 tons; Osaka Iron Works, 12 vessels, 95,400 tons; Harima Dockyard, 16 vessels, 78,500 tons; Mitsubishi Dockyard, Yokohama, 16 vessels, 74,900 tons; Uruga Dockyard, 6 vessels 37,750 tons; and Mitsubishi Dockyards, Kobe vessels, 34,900 tons.

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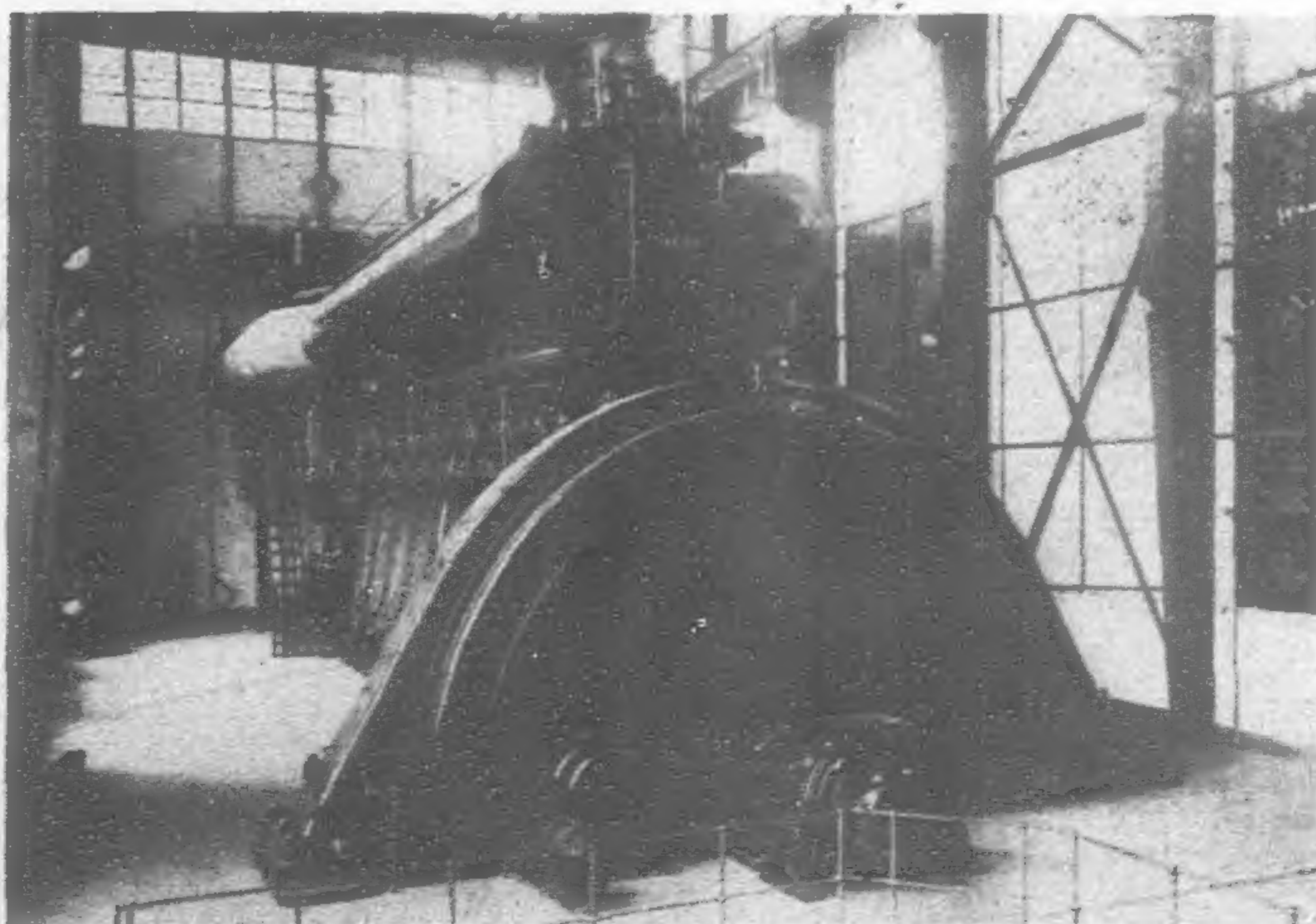
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